Technical Support Document for the Proposed Toxics Rule: Emissions Inventories

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U.S. Environmental Protection Agency
Office of Air Quality Planning and Standards
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Acronyms

AEO Annual Energy Outlook

BEIS Biogenic Emission Inventory System
C3 Category 3 (commercial marine vessels)
CAIR Clean Air Interstate Rule
CAMD EPA‟s Clean Air Markets Division
CAMx Comprehensive Air Quality Model with Extensions
CAP Criteria Air Pollutant
CARB California Air Resources Board
CEM Continuous Emissions Monitoring
CMAQ Community Multiscale Air Quality
CMV Commercial Marine Vessel
DOE Department of Energy
ECA Emissions Control Area
EGU Electric Generating Unit
EISA Energy Independence and Security Act of 2007
EMFAC CARB‟s Emission Factors mobile model
FAA Federal Aviation Administration
FIPS Federal Information Processing Standard
HAP Hazardous Air Pollutant
HWI Hazardous Waste Incinerator
ICR Information Collection Request
IMO International Marine Organization
IPM Integrated Planning Model
ISIS Industrial Sector Integrated Solutions
ITN Itinerant (aircraft operations)
MACT Maximum Achievable Control Technology
MOBILE6 Mobile Source Emission Factor Model, version 6
MOVES Motor Vehicle Emissions Simulator
MSAT2 Final Mobile Source Air Toxics Rule
MWC Municipal Waste Combustor
NAAQS National Ambient Air Quality Standards
NATA National Air Toxics Assessment
NEEDS National Electric Energy Database System
NEI National Emission Inventory
NESHAP National Emissions Standards for Hazardous Air Pollutants
NLEV National Low Emission Vehicle
NMIM National Mobile Inventory Model
NSPS New Source Performance Standard
NSR New Source Review
OAQPS EPA‟s Office of Air Quality Planning and Standards
OECA EPA‟s Office of Enforcement and Compliance
ORL One Record per Line (a SMOKE input format)
OTC Ozone Transport Commission
MP Multipollutant

PFC	Portable Fuel Container
RIA	Regulatory Impact Analysis
RICE	Reciprocating Internal Combustion Engine
RFS2	Revised annual Renewable Fuel Standard
RWC	Residential Wood Combustion
SMOKE	Sparse Matrix Operator Kernel Emissions
SCC	Source Classification Code
SPPD	Sector Policies and Programs Division
TAF	Terminal Area Forecast
TCEQ	Texas Commission on Environmental Quality
TPY	Tons per Year
TR	Federal Transport Rule
TSD	Technical Support Document
VOC	Volatile Organic Compound
WRAP	Western Regional Air Partnership

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1 Introduction

This document provides the details of emissions data processing done in support of the Environmental Protection Agency's (EPA) rulemaking effort for the proposed Toxics Rule which is also referred to as the Utility Maximum Achievable Control Technology Standard (MACT) and New Source Performance Standard (NSPS). The air quality modeling results were used in the Appropriate and Necessary Analysis and the Regulatory Impact Assessment. The emissions and modeling effort consists of three emissions cases: 2005 base case, 2016 base case, and 2016 Control case. The emissions consisted of Criteria Air Pollutants (CAPs) and the following select Hazardous Air Pollutants (HAPs): mercury (Hg), chlorine (CL2), hydrochloric acid or hydrogen chloride (HCL) and benzene, acetaldehyde, formaldehyde and methanol. The latter four are also denoted BAFM.

Table 1-1 provides more information on these emissions cases. The 2016 base case modeling was used to characterize future-year air quality without implementation of the rule. Also included in Table 1-1 are mercury (Hg) zero-out runs that were based on the 2016 base case and 2005 base case to quantify the contributions of mercury emissions from Electric Generating Units (EGUs). This document provides no further discussion on the two simple Hg EGU zero-out runs, which are described in the proposed Toxics Rule Technical Support Document: "*National-scale Mercury Risk Assessment Supporting the Appropriate and Necessary Finding for Coal- and Oil-fired Electric Generating Units*". The modeling outputs for the 2016 base and control cases were then used to quantify the benefits of the proposed Toxics Rule.

Table 1-1. List of cases run in support of the air quality modeling for the Proposed Toxics Rule

Case Name	Internal EPA Abbreviation	Description
2005 base case	2005cr_hg	2005 case created using average-year fires data and an average-year temporal allocation approach for EGUs, to use for computing relative response factors with 2016 the scenario
2005 Hg EGU zero-out	2005cr_hg_ptipm_hgzero	Same as 2005 base case but zero Hg emissions for EGU (ptipm) sector
2016 base case	2016cr2_hg	2016 "baseline" scenario, representing the best estimate for the future year without implementation of the EGU MACT/NSPS.
2016 base with Hg zero-out	2016cr2_hg_ptipmhgzero	Same as 2016 base case but zero Hg emissions for EGU (ptipm) sector
2016 control case	2016cr2_hg_control1	2016 EGU "control" scenario representing a MACT control strategy

The data used in the 2005 emissions cases are the same as those described in the 2005-based, Version 4.1 platform (hereafter the "2005v4.1" platform) document available at Clearinghouse for Inventories and Emissions Factors (CHIEF). The 2005 and future-year emissions scenarios were processed in a form that is required by the Community Multi-scale Air Quality (CMAQ) model. CMAQ simulates the numerous physical and chemical processes involved in the formation, transport, and destruction of ozone, particulate matter and air toxics. As part of the analysis for this rulemaking, CMAQ was used to calculate daily and annual $PM_{2.5}$ concentrations, 8-hr maximum ozone, annual total mercury deposition levels and visibility impairment. Model predictions of $PM_{2.5}$ and ozone are used in a relative sense to estimate scenario-specific, future-year design values of $PM_{2.5}$ and ozone, which are combined with monitoring data to estimate population-level exposures to changes in ambient concentrations for use in estimating health and welfare effects.

We used a 2005 base case approach for the year 2005 emissions scenario. The base case approach uses an average-year fire emissions inventory and average-year EGU temporal profiles, which were based on 3 years of hourly Continuous Emissions Monitoring (CEM) data for EGUs. We use a base case approach to reduce year-specific variability in fires and EGUs between 2005 and the future years. For example, each year has different days and different locations with large fires, unplanned EGU shutdowns, and periods of high electricity demand. By using a base-case approach, the temporal and spatial aspects of the inventory for these sources are maintained into the future year modeling, which avoids potentially spurious year-specific artifacts in air quality modeling estimates. In addition, the 2005 Version 4.1 (v4.1) platform biogenic emissions data is the same as the 2005v4 platform and was held constant between the 2005 case and the 2016 future-year cases. The 2005v4 emissions processing technical support document is available at: ftp://newftp.epa.gov/Air/emismod/2005/2005v4/2005_emissions_tsd_07jul2010.pdf. The only significant data changes between the year 2005 cases in Table 1-1 and future-year cases are emission inventories and speciation approaches.

The future-year inventories, ancillary files, and detailed projection data used for this modeling are available as part of the Toxics Rulemaking, available in the docket at EPA-HQ-OAR-2009-0234. Since the data are large, the data files themselves are not posted with online access through the docket, and so a more convenient access location is the EPA Emissions Modeling Clearinghouse website for its 2005 platform. The Toxics Rule data files are provided as a subheading under this main link.

In the remainder of this document, we provide a description of the approaches taken for the emissions in support of air quality modeling for the Toxics rule. In Section 2, we briefly review the 2005 base case inventory, including ancillary data and issues related to CMAQ support. In Section 3, we describe the development of the future year 2016 base case. In Section 4 we provide data summaries comparing the modeling cases. Finally, Section 5 provides emissions summaries and Section 6 contains the technical references for this document.

2 Development of Base Case 2005 Emission Inventories

As mentioned previously, the 2005 emissions modeling approach for the proposed Toxics Rule used the same data and approaches as the 2005 v4.1 base case platform. In this section, we briefly discuss the modeling sectors in the 2005 base case and future year cases as well as Toxics rule-specific issues related to processing emissions for CMAQ.

2.1 Base case 2005 overview

Table 2-1 lists the platform sectors used for the 2005 base case and future-year base and control cases. It also indicates the associated sectors from the National Emissions Inventory (NEI). Subsequent sections refer to these platform sectors for identifying the emissions differences between the 2005 base case and the 2016 cases. The inputs to the air quality model; including emissions, meteorology, initial conditions, boundary conditions; along with the methods used to produce the inputs and the configuration of the air quality model are collectively known as a „modeling platform". The v4.1 platform contains the same modeling sectors as the 2005 v4 platform; though for some sectors, the emissions data were revised. For additional information on the revisions made, see the 2005-based, Version 4.1 platform document.

Table 2-1. Sectors Used in the 2005v4.1 Emissions Modeling Platform and Description of the 2005 Base Year Data

Platform Sector	2005 NEI Sector	Description and resolution of the data input to SMOKE
EGU sector (also called the IPM sector): ***ptipm***	Point	For all pollutants other than mercury (Hg): 2005 NEI v2 point source EGUs mapped to the Integrated Planning Model (IPM) model using the National Electric Energy Database System (NEEDS) 2006 version 4.10 database. A few revisions were made to the 2005 NEI v2 annual emission estimates as discussed in the 2005-based, Version 4.1 platform document. For Hg: 6/18/2010 version of the inventory used for the 2005 National Air Toxics Assessment (NATA) mapped to IPM using NEEDS version 4.10. The NATA inventory is an update to the 2005 NEI v2 and was divided into EGU and non-EGU sectors consistent with the other pollutants. (We did not actually map the NATA inventory to IPM, but rather applied the mapping that was done to the 2005 NEIv2 to the NATA Hg inventory). We additionally removed Hg from sources from the National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers and Process Heaters (aka "Boiler MACT") Information Collection Request (ICR) database because we included these emissions in the non-EGU sector. For both: Day-specific emissions created for input into SMOKE.
Non-EGU sector (also called the non-IPM sector): ***ptnonipm***	Point	For all pollutants other than Hg: All 2005 NEI v2 point source records not matched to the ptipm sector. Includes all aircraft emissions. Additionally updated inventory to remove duplicates, improve estimates from ethanol plants, and reflect new information collected from industry from the ICR for the Boiler MACT. Includes point source fugitive dust emissions for which county-specific PM transportable fractions were applied. For Hg: The 6/18/2010 version of NATA inventory was used except for modifications to gold mine emissions and removal of Hg from facilities that closed prior to 2005. In addition, Hg emissions developed for the Boiler MACT were used For both: Annual resolution.
Average-fire sector: ***avefire***	N/A	Average-year wildfire and prescribed fire emissions, unchanged from the 2005v4 platform; county and annual resolution.
Agricultural sector: ***ag***	Nonpoint	NH_3 emissions from NEI nonpoint livestock and fertilizer application, county and annual resolution. Unchanged from the 2005v4 platform.
Area fugitive dust sector: ***afdust***	Nonpoint	PM_{10} and $PM_{2.5}$ from fugitive dust sources (e.g., building construction, road construction, paved roads, unpaved roads, agricultural dust) from the NEI nonpoint inventory after application of county-specific PM transportable fractions. Includes county and annual resolution.
Remaining nonpoint sector: ***nonpt***	Nonpoint	Primarily 2002 NEI nonpoint sources not otherwise included in other SMOKE sectors, county and annual resolution. Also includes updated Residential Wood Combustion emissions, year 2005 non-California WRAP oil and gas Phase II inventory and year 2005 Texas and Oklahoma oil and gas emissions. Removed Hg emissions from boilers to avoid double counting with Hg emissions added to the non-EGU (ptnonipm) sector from the Boiler MACT.
Nonroad sector: ***nonroad***	Mobile: Nonroad	Monthly nonroad emissions from the National Mobile Inventory Model (NMIM) using NONROAD2005 version nr05c-BondBase (equivalent to NONROAD2008a, since it incorporated Bond rule

Platform Sector	2005 NEI Sector	Description and resolution of the data input to SMOKE
		revisions to some of the base case inputs and the Bond rule controls did not take effect until later) for all states except California. Monthly emissions for California created from annual emissions submitted by the California Air Resources Board (CARB) for the 2005v2 NEI**.**
locomotive, and non-C3 commercial marine: *alm_no_c3*	Mobile: Nonroad	2002 NEI non-rail maintenance locomotives, and category 1 and category 2 commercial marine vessel (CMV) emissions sources, county and annual resolution. Aircraft emissions are included in the Non-EGU sector (as point sources) and category 3 CMV emissions are contained in the seca_c3 sector
C3 commercial marine: *seca_c3*	Mobile : Nonroad	Annual point source-formatted, year 2005 category 3 (C3) CMV emissions, developed for the rule called "Control of Emissions from New Marine Compression-Ignition Engines at or Above 30 Liters per Cylinder", usually described as the Emissions Control Area (ECA) study. Utilized final projections from 2002, developed for the C3 ECA proposal to the International Maritime Organization (EPA-420-F-10-041, August 2010).
Onroad California, NMIM-based, and MOVES sources not subject to temperature adjustments: *on_noadj*	Mobile: onroad	Three, monthly, county-level components: 1) California onroad, created using annual emissions for all pollutants, submitted by CARB for the 2005 NEI version 2. NH_3 (not submitted by CARB) from MOVES2010. 2) Onroad gasoline and diesel vehicle emissions from MOVES2010 not subject to temperature adjustments: exhaust CO, NO_X, VOC, NH3, benzene, formaldehyde, acetaldehyde, 1,3-butadiene, acrolein, naphthalene, brake and tirewear PM, exhaust diesel PM, and evaporative VOC, benzene, and naphthalene. 3) Onroad emissions for Hg from NMIM using MOBILE6.2, other than for California.
Onroad cold-start gasoline exhaust mode vehicle from MOVES subject to temperature adjustments: *on_moves_startpm*	Mobile: onroad	Monthly, county-level MOVES2010-based onroad gasoline emissions subject to temperature adjustments. Limited to exhaust mode only for PM species and naphthalene. California emissions not included. This sector is limited to cold start mode emissions that contain different temperature adjustment curves from running exhaust (see on_moves_runpm sector).
Onroad running gasoline exhaust mode vehicle from MOVES subject to temperature adjustments: *on_moves_runpm*	Mobile: onroad	Monthly, county-level MOVES2010-based onroad gasoline emissions subject to temperature adjustments. Limited to exhaust mode only for PM species and Naphthalene. California emissions not included. This sector is limited to running mode emissions that contain different temperature adjustment curves from cold start exhaust (see on_moves_startpm sector).
Biogenic: *biog*	N/A	Hour-specific, grid cell-specific emissions generated from the BEIS3.14 model -includes emissions in Canada and Mexico.
Other point sources not from the NEI: *othpt*	N/A	Point sources from Canada's 2006 inventory and Mexico's Phase III 1999 inventory, annual resolution. Also includes annual U.S. offshore oil 2005v2 NEI point source emissions.
Other point sources not from the NEI, Hg only: *othpt_hg*	N/A	Annual year 2000 Canada speciated mercury point source emissions.
Other nonpoint	N/A	Annual year 2006 Canada (province resolution) and year 1999 Mexico

Platform Sector	2005 NEI Sector	Description and resolution of the data input to SMOKE
and nonroad not from the NEI: *othar*		Phase III (municipio resolution) nonpoint and nonroad mobile inventories.
Other nonpoint sources not from the NEI, Hg only: *othar_hg*	N/A	Annual year 2000 Canada speciated mercury from nonpoint sources.
Other onroad sources not from the NEI: *othon*	N/A	Year 2006 Canada (province resolution) and year 1999 Mexico Phase III (municipio resolution) onroad mobile inventories, annual resolution.

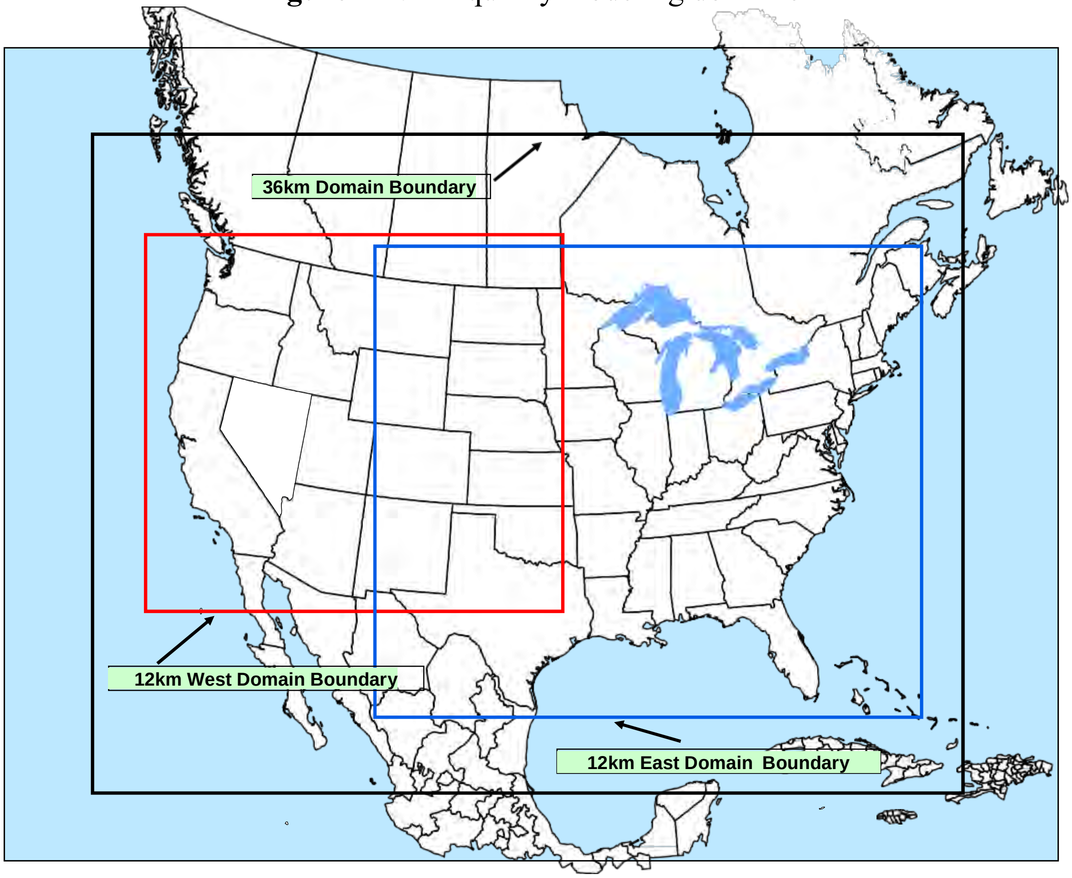
As discussed in the 2005 v4.1 platform documentation, we processed all emissions data with the Sparse Matrix Operator Kernel Emissions (SMOKE) modeling system, version 2.6. More details about SMOKE including user documentation.

For the 2005 base case, all inventory and ancillary input data files used as inputs for this rule can be found at the 2005-based platform website Clearinghouse for Inventories and Emission Factors (CHIEF).

2.2 2005 Proposed Toxics Rule custom processing configuration

In support of the proposed Toxics Rule, EPA modeled the air quality in the East and the West (2 separate modeling domains), each using a 12-km horizontal grid resolution. The 12-km modeling domains were "nested" within a modeling domain covering the lower 48 states using a 36-km grid resolution. The air quality predictions from the 36 km Continental US (CONUS) domain were used to provide incoming "initial" and "boundary" concentrations for the Eastern 12 km domain. A map of the air quality modeling domains is in Figure 2-1.

Figure 2-1. Air quality modeling domains



All three grids use a Lambert-Conformal projection, with Alpha = 33º, Beta = 45º and Gamma = -97º, with a center of X = -97º and Y = 40º. Other specific parameters for these grids are provided in the Air Quality Modeling Technical Support Document (EPA, 2011) for the Toxics Rule. More details on the grid parameters are provided in the 2005v4.1 platform documentation.

3 Development of 2016 Future-Year Base Case Emission Inventories

This section describes the methods we used for developing the 2016 future-year base-case emissions. The ancillary input data are very similar in the future-year scenarios to those in the 2005 base case except for the speciation profiles used for gasoline-related sources, which change in the future to account for increased ethanol usage in gasoline. The specific speciation profile changes are discussed in Sections 3.2.8 (stationary source impacts) and 3.3.5 (mobile source impacts).

The future base case projection methodologies vary by sector. The 2016 base case represents predicted emissions in the absence of any further controls beyond those Federal measures already promulgated, or those expected to be promulgated prior to the Toxics Rule proposal date. For EGU emissions (ptipm sector), the emissions reflect state rules and federal consent decrees through December 1, 2010 and incorporate information on existing controls collected through the Information Collection Request (ICR) for the Toxics Rule. For mobile sources (on_noadj, on_moves_runpm, and on_moves_startpm sectors), all national measures for which data were available at the time of modeling have been included. The future base-case scenarios do reflect projected economic changes and fuel usage for EGU and mobile sectors. For non-EGU point (ptnonipm sector) and nonpoint stationary sources (nonpt, ag, and afdust sectors), any local control programs that might be necessary for areas to attain the 1997 $PM_{2.5}$ NAAQS annual standard, 2006 PM NAAQS (24-hour) standard, and the 1997 ozone NAAQS are generally not included in the future base case projections. One exception are some NOx and VOC reductions associated with the New York (NY) State Implementation Plan (SIP), which were added as part of a larger effort to start including more local control information. This is described further in Section 3.2.6. The following bullets summarize the projection methods used for sources in the various sectors, while additional details and data sources are given in Table 3-1:

- IPM sector (ptipm): Unit-specific estimates from IPM, version 4.10 (interim version developed for the Toxics Rule air quality modeling).
- Non-IPM sector (ptnonipm): Projection factors and percent reductions reflect emission reductions due to control programs, plant closures, consent decrees and settlements, and one 1997 ozone NAAQS State Implementation Plan for New York. We also used projection approaches for point-source livestock and aircraft and gasoline stage II emissions that are consistent with projections used for the sectors that contain the bulk of these emissions. Terminal area forecast (TAF) data aggregated to the national level were used for aircraft to account for projected changes in landing/takeoff activity. Year-specific speciation was applied to some portions of this sector and is discussed in Section 3.2.8.
- Average fires sector (avefire): No growth or control.
- Agricultural sector (ag): Projection factors for livestock estimates based on expected changes in animal population from 2005 to 2016 using 2005 Department of Agriculture data; no growth or control for NH_3 emissions from fertilizer application.
- Area fugitive dust sector (afdust): Projection factors for dust categories related to livestock estimates based on expected changes in animal population; no growth or control for other categories in this sector.
- Remaining nonpoint sector (nonpt): Projection factors that reflect emission reductions due to control programs. Residential wood combustion projections based on growth in lower-emitting stoves and retirement of higher emitting stoves. Portable Fuel Container (PFC) projection factors reflecting impact of the final Mobile Source Air Toxics (MSAT2) rule. Gasoline stage II projection factors based on National Mobile Inventory Model (NMIM)-estimated VOC refueling estimates for future years. Year-specific speciation was applied to some portions of this sector (i.e., gasoline-related emissions) and is discussed in Section 3.2.8.
- Nonroad mobile sector (nonroad): Other than for California, adjusted output from a 2015 run of NMIM that utilized the NR05d-Bond-final version of NONROAD (which is equivalent to NONROAD2008a) to the year 2016. Adjustment to 2016 was made by applying factors by pollutant, source category code (SCC), and mode (exhaust/evap). Factors were computed as the ratio of 2016 to 2015 national-level emissions from NMIM runs. Adjustment not made for NH3 which used the 2015 NMIM data. Includes final controls from the final locomotive-marine and small spark ignition OTAQ rules. California-specific data provided by the state of California, except NH_3 used 2015 NMIM. Year-specific speciation was applied to some portions of this sector and is discussed in Section 3.3.5. Hg was kept at 2005 levels.
- Aircraft, locomotive, and non-Class 3 commercial marine sector (alm_no_c3): Projection factors for Class 1 and Class 2 commercial marine and locomotives which reflect activity growth and final locomotive-marine controls. Hg was kept at 2005 levels.
- Class 3 commercial marine vessel sector (seca_c3): base year 2005 emissions grown and controlled to 2016, incorporating controls based on Emissions Control Area (ECA) and International Marine Organization (IMO) global NO_X and SO_2 controls. Hg was dropped from this sector for both 2005 and 2016.

- Onroad no-adjustment for temperature mobile sector (on_noadj): MOVES2010 run (state-month) for 2016 and results disaggregated to the county level using NMIM 2015. California-specific data provided by the state of California. VOC speciation uses different future year values to take into account both increase in ethanol, and the existence of Tier 2 vehicles which use a different speciation profile. Hg is kept at 2005 levels.
- Onroad PM gasoline running mode sector (on_moves_startpm): Running mode MOVES2010 future year state-month estimates for PM and naphthalene, apportioned to the county level using NMIM 2015 state-county ratios matched to vehicle and road types. Use future year temperature adjustment file for adjusting the 72°F-supplied emissions (for elemental and organic carbon) based grid cell hourly temperature (lower temperatures result in increased emissions).
- Onroad PM gasoline start mode sector (on_moves_startpm): Cold start MOVES2010 future-year state-month estimates for PM and naphthalene, apportioned to the county level using NMIM 2015 state-county ratios of local urban and rural roads by vehicle type. Use future-year temperature adjustment file for adjusting the 72°F emissions (for elemental and organic carbon) based on grid cell hourly temperatures (lower temperatures result in increased emissions).
- Other nonroad/nonpoint (othar): No growth or control.
- Other nonpoint speciated mercury (othar_hg): No growth or control.
- Other onroad sector (othon): No growth or control.
- Other nonroad/nonpoint (othar): No growth or control.
- Other point (othpt): No growth or control.
- Other point speciated mercury (othpt_hg): No growth or control.
- Biogenic: 2005 emissions used for all future-year scenarios to be consistent with 2005 meteorology used for all scenarios.

Table 3-1 summarizes the control strategies and growth assumptions by source type used to create the 2016 base case emissions from the 2005 base-case inventories. All Mexico, Canada, and offshore oil emissions are unchanged in all future case scenarios from those in the 2005 base case. Emission summaries by sector for 2005 and future years are provided in Section 4.

The remainder of this section is organized either by source sector or by specific emissions category within a source sector for which a distinct set of data were used or developed for the purpose of projections for the proposed Toxics Rule. This organization allows consolidation of the discussion of the emissions categories that are contained in multiple sectors, because the data and approaches used across the sectors are consistent. Sector names associated with the emissions categories are provided in parentheses. A list of inventory datasets used for this and all cases is provided in Appendix A.

Table 3-1. Control strategies and growth assumptions for creating 2016 base case emissions inventories from the 2005 base case

Control Strategies and/or growth assumptions (grouped by affected pollutants or standard and approach used to apply to the inventory)	**Pollutants affected**	**Approach/ reference**
Non-EGU Point (ptnonipm sector) projection approaches carried forward from the Proposed Transport Rule[a,b]		
<u>MACT rules, national, VOC: national applied by SCC, MACT</u> Boat Manufacturing Wood Building Products Surface Coating Generic MACT II: Spandex Production, Ethylene manufacture Large Appliances Miscellaneous Organic NESHAP (MON): Alkyd Resins, Chelating Agents, Explosives, Phthalate Plasticizers, Polyester Resins, Polymerized Vinylidene Chloride Reinforced Plastics Asphalt Processing & Roofing Iron & Steel Foundries Metal: Can, Coil Metal Furniture Miscellaneous Metal Parts & Products Municipal Solid Waste Landfills Paper and Other Web Plastic Parts Plywood and Composite Wood Products Carbon Black Production Cyanide Chemical Manufacturing Friction Products Manufacturing Leather Finishing Operations Miscellaneous Coating Manufacturing Organic Liquids Distribution (Non-Gasoline) Refractory Products Manufacturing Sites Remediation	VOC	EPA, 2007a
Consent decrees on Companies (based on information from the Office of Enforcement and Compliance Assurance – OECA) apportioned to plants owned/operated by the Companies	VOC, CO, NOx, PM, SO_2	Appendix B
DOJ Settlements: plant SCC controls for: Alcoa, TX Premcor (formerly Motiva), DE	All	1
Refinery Consent Decrees: plant/SCC controls	NOx, PM, SO_2	2
Municipal Waste Combustor Reductions –plant level	PM	4
Hazardous Waste Combustion	PM	3
Hospital/Medical/Infectious Waste Incinerator Regulations	NO_X, PM, SO_2	EPA, 2005
Large Municipal Waste Combustors – growth applied to specific plants	All (including Hg)	4
MACT rules, plant-level, VOC: Auto Plants	VOC	5
MACT rules, plant-level, PM & SO_2: Lime Manufacturing	PM, SO_2	6
MACT rules, plant-level, PM: Taconite Ore	PM	7
a. The implementation of these rules was changed to reflect a 2016 future year, rather than 2012 / 2014 b. We inadvertently did not apply closures that had been applied for the Transport Rule proposal; emissions from these plants sum to 3,300 tons VOC, 178 tons $PM_{2.5}$, 1,982 tons SO_2, 1,639 tons NO_X, 6 tons NH_3 and 379 tons CO. At the state level, the largest impact is in West Virginia for both NO_X and SO_2 (717 tons NO_X, which is slightly under 1% of total anthropogenic NO_X emissions and 1,604 tons SO_2 which is 0.5% of total SO_2 emissions for that state). All other NO_X and SO_2 errors are under 500 tons at the state level and only a fraction of a percent impact on total emissions.		
Nonpoint (nonpt sector) projection approaches carried forward from the Proposed Transport Rule		
Municipal Waste Landfills: projection factor of 0.25 applied	All	EPA, 2007a
Livestock Emissions Growth from year 2002 to year 2016	NH3, PM	8
Residential Wood Combustion Growth and Change-outs from year 2005 to Year 2016	All	9

Gasoline Stage II growth and control from year 2005 to year 2016	VOC	10
Portable Fuel Container Mobile Source Air Toxics Rule 2 (MSAT2) inventory growth and control from year 2005 to year 2016	VOC	11
Additional projections used in the proposed Toxics Rule modeling for non-EGU point sources (ptnonipm sector)[a]		
NESHAP: Portland Cement (09/09/10) – plant level based on Industrial Sector Integrated Solutions (ISIS) policy emissions in 2013. The ISIS results are from the ISIS-Cement model runs for the NESHAP and NSPS analysis of July 28, 2010 and include closures	Hg, NO_X, SO2, PM, HCL	12
NESHAP: Industrial, Commercial, Institutional (ICI), Boilers (based on proposed rule reductions 04-15-10) -- finalized 2/2011	Hg, SO_2, HCL, PM	Section 3.2.6
NESHAP: Gold Mine Ore Processing and Production Area Source Category (based on proposed rule 04-15-10) – finalized 12/2010	Hg	13 and Appendix C
NESHAP: Mercury Emissions From Mercury Cell Chlor-Alkali Plants-Final Rule (12/19/03)	Hg	Appendix D
Pulp and Paper Project smelter replacement for Georgia Pacific plant in VA (12/2009)	Hg	Appendix D
NESHAP: Electric Arc Furnace Steelmaking Facilities (12/28/2007)	Hg	Appendix D
NESHAP: Hazardous Waste Combustion (12/19/2005)	Hg	Appendix D
New York ozone SIP controls	VOC, NO_X, HAP VOC	14
Additional Plant and Unit closures provided by state, regional, and EPA agencies and additional consent decrees	All	Appendix E
Emission Reductions resulting from controls put on specific boiler units (not due to MACT) after 2005, identified through analysis of the control data gathered from the ICR from the ICI Boiler NESHAP.	NO_X, SO_2, HCL	Section 3.2.6
NESHAP: Reciprocating Internal Combustion Engines (RICE)[b]	NO_X, CO, PM	Appendix F
Replaced 2005 with 2008 emissions for Corn Products International, Cook Cty, Illinois, due to the shutdown of 3 boilers and addition of a new boiler (subject to Prevention of Significant Deterioration and Requirements) . Agency Identifier: 031012ABI (ILEPA)		15

a. We gathered the data on the consent decrees for the LaFarge (cement manufacturing) and St. Gobain (glass manufacturing) facility**,** both of which were signed in Jan 2010. However, technical difficulties with the projections software resulted in these reductions not being included for the 2016 projections. The resulting emissions are therefore too high in CA, IL, IN, KS, LA, MA, MI, MO, NC, OH, OK, PA, TX, WA, and WI, and are summarized nationally below. Although these missed reductions are large, they have a minimal impact on our overall analysis because the modeling analysis for the RIA captures an appropriate difference between the future base and policy cases and that difference is unaffected by this omission since it was omitted from both the base and the policy cases.

CO (tons)	NOX (tons)	PM10 (tons)	PM2_5 (tons)	SO2 (tons)	VOC (tons)
110	13,214	269	210	16,270	6

b. Note that SO_2 reductions are expected to occur to due fuel sulfur limits but were excluded from the projection. They were expected to reduce SO_2 by 27,000 tons, nationwide. This omission is expected to have negligible impacts on our analysis since the reductions were omitted from both the base and policy cases.

Additional projections used in the proposed Toxics Rule modeling for Nonpoint sources (nonpt sector)		
NESHAP: Reciprocating Internal Combustion Engines (RICE) (as with ptnonipm, we excluded the low sulfur fuel requirements)	NO_X, CO, VOC, PM	Appendix F
Use Phase II WRAP 2018 Oil and Gas, and apply RICE controls to these emissions	VOC, SO_2, NO_X, CO	Section 3.2.7
Use 2008 Oklahoma and Texas Oil and Gas, and apply RICE controls to these emissions	VOC, SO_2, NO_X, CO, PM	Section 3.2.7
New York ozone SIP controls	VOC	15

APPROACHES/REFERENCES- Stationary Sources:

1. For Alcoa consent decree, for Motiva: used information sent by State of Delaware
2. Used data provided by EPA, OAQPS, Sector Policies and Programs Division (SPPD) –see Section 1.
3. Obtained from Anne Pope, US EPA - Hazardous Waste Incinerators criteria and hazardous air pollutant controls carried over from 2002 Platform, v3.1.
4. Used data provided by EPA, OAQPS SPPD expert –see Section 1.
5. Percent reductions and plants to receive reductions based on recommendations by rule lead engineer, and are consistent with the reference: EPA, 2007a
6. Percent reductions recommended are determined from the existing plant estimated baselines and estimated reductions as shown in the Federal Register Notice for the rule. SO_2 percent reduction are computed by 6,147/30,783 = 20% and PM_{10} and $PM_{2.5}$ reductions are computed by 3,786/13,588 = 28%
7. Same approach as used in the 2006 Clean Air Interstate Rule (CAIR), which estimated reductions of "PM emissions by 10,538 tpy, a reduction of about 62%." Used same list of plants as were identified based on tonnage and SCC from CAIR.
8. Except for dairy cows and turkeys (no growth), based on animal population growth estimates from the US Department of Agriculture (USDA) and the Food and Agriculture Policy and Research Institute. See Section 3.2.1.
9. Growth and Decline in woodstove types based on industry trade group data, See Section. See Section 3.2.2.
10. VOC emission ratios of year 2016 (linear interpolation between 2015 and 2020) -specific from year 2005 from the National Mobile Inventory Model (NMIM) results for onroad refueling including activity growth from VMT, Stage II control programs at gasoline stations, and phase in of newer vehicles with onboard Stage II vehicle controls.
11. VOC and benzene emissions for year 2016 (linear interpolation between 2015 and 2020) from year 2002 from MSAT2 rule (EPA, 2007b)
12. Data files for the cement sector provided by Elineth Torres, EPA-SPPD, from the analysis done for the Cement NESHAP: The ISIS documentation and analysis for the cement NESHAP/NSPS is in the docket of that rulemaking-docket # EPA-HQ-OAR-2002-005. The Cement NESHAP is in the Federal Register: September 9, 2010 (Volume 75, Number 174, Page 54969-55066
13. Data provided by Chuck French, US EPA, plant-specific emissions after the rule were estimated. Consistent with proposed rule for Gold Mine Ore Processing NESHAP: 75 FR 22469.
14. NO_X and VOC reductions obtained from Appendix J in NY Department of Environmental Conservation Implementation Plan for Ozone (February 2008) Section 3.2.6.
15. The 2008 data used came from Illinois‟ submittal of 2008 emissions to the NEI.

Onroad mobile and nonroad mobile controls (list includes all key mobile control strategies but is not exhaustive)[a]		
National Onroad Rules: Tier 2 Rule 2007 Onroad Heavy-Duty Rule Final Mobile Source Air Toxics Rule (MSAT2) Renewable Fuel Standard	all	
Local Onroad Programs: National Low Emission Vehicle Program (NLEV) Ozone Transport Commission (OTC) LEV Program	VOC	2
National Nonroad Controls: Clean Air Nonroad Diesel Final Rule – Tier 4 Control of Emissions from Nonroad Large-Spark Ignition Engines and Recreational Engines (Marine and Land Based): "Pentathalon Rule" Clean Bus USA Program Control of Emissions of Air Pollution from Locomotives and Marine Compression-Ignition Engines Less than 30 Liters per Cylinder	all	3,4,5
Aircraft:	all	6

Itinerant (ITN) operations at airports to year 2020		
Locomotives: Energy Information Administration (EIA) fuel consumption projections for freight rail Clean Air Nonroad Diesel Final Rule – Tier 4 Locomotive Emissions Final Rulemaking, December 17, 1997 Control of Emissions of Air Pollution from Locomotives and Marine	all	EPA, 2009; 7; 4
Commercial Marine: Category 3 marine diesel engines Clean Air Act and International Maritime Organization standards (April, 30, 2010) EIA fuel consumption projections for diesel-fueled vessels OTAQ ECA C3 Base 2020 inventory for residual-fueled vessels Clean Air Nonroad Diesel Final Rule – Tier 4 Emissions Standards for Commercial Marine Diesel Engines, December 29, 1999 Tier 1 Marine Diesel Engines, February 28, 2003	all	7; EPA, 2009
a. These control programs are the same as were used in the proposed Transport Rule except for the C3 marine standards of April 2010, which are included in the Toxics Rule but were not included in the proposed transport rule.		

APPROACHES/REFERENCES – Mobile Sources

1. Clean Air Markets
2. Only for states submitting these inputs: Transportation, Air Pollution, and Climate Change
3. Regulations for Emissions from Vehicles and Engines
4. Clean School Bus
5. Overview of EPA's Emission Standards for Marine Engines
6. Federal Aviation Administration (FAA) Terminal Area Forecast (TAF) System, December 2007.
7. Regulations for Emissions from Vehicles and Engines

3.1 Stationary Source Projections: EGU sector (ptipm)

The future-year data for the ptipm sector used in the air quality modeling were created by an interim version 4.10 of the Integrated Planning Model (IPM) (Clean Air Markets). The IPM is a multiregional, dynamic, deterministic linear programming model of the U.S. electric power sector. Version 4.10 reflects state rules and consent decrees through December 1, 2010 and incorporates information on existing controls collected through the Information Collection Request (ICR) for the proposed Toxics Rule. Units with SO_2 or NO_X advanced controls (e.g., scrubber, SCR) that were not required to run for compliance with Title IV, New Source Review (NSR), state settlements, or state-specific rules were modeled by IPM to either operate those controls or not based on economic efficiency parameters. For the modeling data files, units with advanced mercury controls (e.g., ACI) were assumed to operate those controls in states with mercury requirements. Note that this base case includes the proposed Transport Rule, which is expected to be finalized in June, 2011. Speciated mercury emissions were estimated using mercury speciation factors, which are assigned based on coal rank (e.g., bituminous, sub-bituminous, lignite), firing type, boiler/burner type, and post-combustion emissions controls. These are the same factors as were used in the Clean Air Mercury Rule and are provided in Appendix G. Further details on the EGU emissions inventory used for this proposal can be found in the proposed Toxics Rule IPM Technical Support Document.

IPM is run in 5 year increments. The IPM 2015 results are valid for representing 2014, 2015, and 2016. As explained in the IPM TSD, additional steps were taken to ensure that the results were valid for use in a 2014, 2015 or 2016 model run.

Directly emitted PM emissions (i.e., $PM_{2.5}$ and PM_{10}) from the EGU sector are computed via a post processing routine which applies emission factors to the IPM-estimated fuel throughput based on fuel, configuration and controls to compute the filterable and condensable components of PM. This methodology is documented in the IPM TSD. For the post processing of the IPM data used for the air quality modeling, an erroneous natural gas emission factor that was too high by about a factor of 75 was used. This was responsible for an over-prediction in directly emitted $PM_{2.5}$ emissions from the EGU sector of 85 thousand tons in the base case. This erroneous emissions factor was used in both the base and policy cases. For areas of the country in which more natural gas is projected to be used in the policy case, the emission factor error resulted in an overestimate of PM emissions in the policy case. This error does not impact secondary PM formation which is due to emissions of precursors such as SO_2.

Appendix H further details the emission factor error.

We adjusted the inventory files resulting from the IPM post processing to account for criteria pollutant reductions from the proposed Boiler MACT, which impacts only units that are the less than 25 megawatt (MW). For mercury from these units, we took a different approach because we used the Boiler MACT mercury ICR data directly in our modeling data files, as explained next.

For mercury, we removed the emissions from the IPM sector data for sources matched to the Boiler MACT ICR data to avoid double counting the ptipm sector boiler Hg with the ICR data, which was incorporated only into the ptnonipm sector. We could not match ICR units directly to NEI or IPM units because the identification codes used in the ICR database were different from those in the NEI and IPM outputs. Consequently, we developed the following criteria to prevent double counting of the Hg emissions. Emissions of Hg were removed from the IPM outputs if a unit had a design capacity less than 25 MW and the facility matched a facility in the ICR database. The matching was done using the NEI_UNIQUE_ID field in the NEI and IPM output files[1]. This approach resulted in the removal of 0.124 tons of Hg from the 2016 base year emissions ptipm sector emissions.

For the other pollutants, we applied reductions to ptipm data intended to represent the major Boiler National Emissions Standards for Hazardous Air Pollutants (NESHAP). In particular, we adjusted unit level SO_2, PM10, $PM_{2.5}$, CO, HCL and VOC using unit-specific reduction information from the Boiler MACT ICR database. Because we were unable to match the specific units from the Boiler MACT ICR to the units in the ptipm file, we used the following approach:

(1) Match the ptipm sector inventory and the Boiler MACT data at the facility level.
(2) For facilities that match, use only units that are less than 25 MW and adjust only processes from these units that have the same fuel type as listed in the ICR boiler MACT database.

Since the boiler MACT ICR fuels do not match one-to-one with the fuels described by the source classification codes in the IPM outputs, we used a fuels crosswalk. Application of these unit-specific reductions resulted in a reduction of 821 tons of CO, 725 tons HCL, 546 tons $PM_{2.5}$, 20,239 tons SO_2 and18 tons of VOC. Impacts at the state-level are shown in Table 3-2.

[1] The NEI_UNIQUE_ID was added to the 7,740 records (approximately 1,500 facilities) of the ICR data and this allowed matching of the boiler MACT ICR data to the NEI at a facility level. Roughly 1,250 of the 1,500 facilities in the ICR database, representing 83% of the ICR SO_2 emissions were mapped at the facility level.

Table 3-2. Adjustment to IPM emissions due to application of Boiler MACT.

	CO (2016 tons)		HCL (2016 tons)		PM2_5 (2016 tons)		SO2 (2016 tons)		VOC (2016 tons)	
	IPM Base	Boiler MACT % Reduct.	IPM Base	Boiler MACT % Reduct.	IPM Base	Boiler MACT % Reduct.	IPM Base	Boiler MACT % Reduct.	IPM Base	Boiler MACT % Reduct.
AL	17,518	0	9,086	0	13,821	0	172,198	0	1,297	0
AZ	10,789	0	422	0	8,243	0	25,235	0	867	0
AR	10,380	0	8,265	0	4,358	0	88,049	0	651	0
CA	41,700	0	242	0	10,693	0	4,886	0	818	0
CO	9,428	18	5,191	52	4,469	3	79,129	915	682	1
CT	8,958	0	667	0	1,715	0	2,715	0	108	0
DE	1,544	0	29	0	606	0	1,975	0	47	0
FL	64,017	0	6,777	0	26,822	0	172,059	0	1,929	0
GA	12,583	0	2,555	0	14,721	0	91,901	0	1,175	0
ID	553	0	0	0	189	0	0	0	14	0
IL	19,707	0	11,375	0	10,903	25	166,000	0	1,968	0
IN	22,623	75	17,443	16	21,258	9	229,802	2,077	2,100	1
IA	7,828	16	9,064	51	5,290	22	98,632	1,276	781	2
KS	5,146	0	3,361	0	4,607	0	61,664	0	699	0
KY	32,492	0	3,132	0	13,446	0	123,098	0	1,570	0
LA	22,730	0	7,020	0	4,400	0	85,987	0	656	0
ME	2,224	0	23	0	165	0	289	0	18	0
MD	9,852	0	1,743	0	3,979	0	37,665	0	463	0
MA	7,702	0	402	0	3,495	0	9,340	0	265	0
MI	17,493	18	17,396	41	6,475	18	169,757	428	1,264	2
MN	6,169	33	2,077	155	9,250	70	51,124	3,728	648	4
MS	7,764	0	4,022	0	2,777	0	56,006	0	409	0
MO	14,359	63	19,201	126	7,464	114	172,031	4,870	1,682	1
MT	3,616	0	512	0	2,317	0	12,565	0	247	0
NE	4,699	0	8,122	0	2,693	0	77,965	0	546	0
NV	5,783	0	460	0	10,665	0	11,429	0	336	0
NH	2,415	0	191	0	1,174	0	4,723	0	107	0
NJ	8,669	0	112	0	3,600	0	7,769	0	328	0
NM	7,969	0	103	0	5,782	0	11,353	0	544	0
NY	20,012	0	1,674	0	7,098	0	35,139	0	671	0
NC	10,933	509	1,396	156	11,935	22	77,091	5,456	942	5
ND	7,268	0	2,836	0	5,923	0	119,480	0	858	0
OH	27,806	29	12,205	18	21,828	240	202,779	156	1,929	2
OK	26,742	0	10,618	0	7,290	0	139,801	0	909	0
OR	2,204	0	1,130	0	876	0	11,102	0	100	0
PA	31,503	0	3,278	0	21,826	0	152,951	0	1,871	0
RI	1,594	0	0	0	544	0	0	0	40	0
SC	9,670	0	2,586	0	10,917	0	105,085	0	706	0
SD	679	0	1,390	0	704	0	28,170	0	127	0

	CO (2016 tons)		HCL (2016 tons)		PM2_5 (2016 tons)		SO2 (2016 tons)		VOC (2016 tons)	
	IPM Base	Boiler MACT % Reduct.	IPM Base	Boiler MACT % Reduct.	IPM Base	Boiler MACT % Reduct.	IPM Base	Boiler MACT % Reduct.	IPM Base	Boiler MACT % Reduct.
TN	7,351	0	7,304	0	6,855	0	106,762	0	948	0
TX	105,672	0	26,701	0	38,275	0	421,102	0	5,051	0
UT	4,090	0	949	0	5,074	0	32,636	0	487	0
VT	0	0	0	0	0	0	0	0	0	0
VA	14,037	0	1,199	0	7,470	0	45,726	0	563	0
WA	3,544	0	2,968	0	1,534	0	29,165	0	206	0
WV	11,783	0	2,361	0	16,131	0	127,788	0	1,223	0
WI	14,789	61	7,166	110	6,259	24	77,675	1,333	993	1
WY	7,499	0	2,582	0	7,362	0	55,571	0	923	0
Tribal data	273	0	0	0	93	0	0	0	7	0
Grand Total	**694,158**	**821**	**227,335**	**725**	**383,370**	**546**	**3,793,365**	**20,239**	**40,775**	**18**

After the Boiler MACT reductions were applied, we generated day-specific emissions for input to SMOKE. The approach was modified from the base year to account for summer and winter differences in emissions that are provided by CAMD. In particular, CAMD provides the average-day summer and average-day winter emissions. These are used in the process of developing monthly emissions as shown in Figure 3-1. Daily emissions use the same approach as 2005, which is to apply state averaged month-to-day factors from the 2005 CEM data for NO_X, SO_2 and heat input (the heat input is used for other pollutants).

Figure 3-1. Approach to Compute Monthly Emissions from the IPM data

If month ≥ May and month ≤ September:

Emissions$_m$ (tons/month) = annualized_summer_emissions * (5/12) * summer_monthly_fraction$_m$

Otherwise:

Emissions$_m$ (tons/month) = annualized_winter_emissions * (7/12) * winter_monthly_fraction$_m$

Where:
m = month of the year
Annualized_summer_emissions = the emissions value in the summer SMOKE input file from post-processed IPM data provided by CAMD
Annualized_winter_emissions = the emissions value in the winter SMOKE input file from post-processed IPM data provided by CAMD

Winter_monthly_fraction is computed as:

$$f_m = \frac{D_m}{\sum_{n=January}^{April} D_n + \sum_{n=October}^{December} D_n}$$

Summer_monthly_fraction is computed as:

$$f_m = \frac{D_m}{\sum_{n=May}^{September} D_n}$$

Where:
D = NOx monthly CEM fractions for allocating NOx emissions which are based on state averaged values of the CEM data for 2004, 2005 and 2006
SO2 monthly CEM fractions for allocating SO2 emissions which are based on state averaged values of the CEM data for 2004, 2005 and 2006,
Heat input monthly CEM fractions for allocating all other pollutants which are based on state averaged values of the CEM data for 2004, 2005 and 2006

3.2 Stationary Source Projections: non-EGU sectors (ptnonipm, nonpt, ag, afdust)

To project U.S. stationary sources other than ptipm, we applied growth factors and/or controls to certain categories within the ptnonipm, nonpt, ag and afdust platform sectors. This subsection provides details on the data and projection methods used for these sectors. In estimating future-year emissions, we assumed that emissions growth does not track with economic growth for many stationary non-IPM sources. This "no-growth" assumption is based on an examination of historical emissions and economic data. While we are working toward improving the projection approach in future emissions platforms, we are still using the no-growth assumption for the 2005, v4.1 platform. More details on the rationale for this approach can be found in Appendix D of the Regulatory Impact Assessment for the PM NAAQS rule (EPA, 2006).

Year-specific projection factors for year 2016 were used for creating the 2016 base case unless noted otherwise. Growth factors (and control factors) are provided in the following sections where feasible. However, some sectors used growth or control factors that varied geographically and their contents could not be provided in the following sections (e.g., gasoline distribution varies by county and pollutant and has thousands of records). If the growth or control factors for a sector are not provided in a table in this document, they are available as a "projection" or "control" packet for input to SMOKE on the v4.1 platform website (see the end of Section 1).

3.2.1 Livestock emissions growth (ag, afdust)

Growth in ammonia (NH_3) and dust (PM_{10} and $PM_{2.5}$) emissions from livestock in the ag and afdust and ptnonipm sectors was based on projections of growth in animal population. While there are some livestock emissions in ptnonipm, (very small compared to ag sector) the control packet was inadvertently not applied to that sector. This results in an underestimate of NH_3 of roughly 1,620 tons in 2016 (primarily in Kansas and Minnesota for which the NH_3 were reported at specific farms in the point source inventory), and for $PM_{2.5}$ the 2016 underestimate is 3 tons. All of these omissions have a negligible impact on the results of this analysis because the mass impacted is so small and because the omissions were made in both the future base and policy cases.

Table 3-3 provides the growth factors from the base case 2005 emissions to 2016 for animal categories applied to the ag and afdust sectors for livestock-related SCCs. For example, year 2016 beef emissions are 1.9% larger than the 2005 base case emissions. Except for dairy cows and turkey production, the animal projection factors are derived from national-level animal population projections from the U.S. Department of Agriculture (USDA) and the Food and Agriculture Policy and Research Institute (FAPRI). For dairy cows and turkeys, we assumed that there would be no growth in emissions. This assumption was based on an analysis of historical trends in the number of such animals compared to production rates. Although productions rates have increased, the number of animals has declined. Thus, we do not believe that production forecasts provide representative estimates of the future number of cows and turkeys; therefore, we did not use these forecasts for estimating future-year emissions from these animals. In particular, the dairy cow population is projected to decrease in the future as it has for the past few decades; however, milk production will be increasing over the same period. Note that the ammonia emissions from dairies are not directly related to animal population but also nitrogen excretion. With the cow numbers going down and the production going up we suspect the excretion value will be changing, but we assumed no change because we did not have a quantitative estimate.

The inventory for livestock emissions used 2002 emissions values therefore, our projection method projected from 2002 rather than from 2005.

Appendix E in the 2002v3 platform documentation provides the animal population data and regression curves used to derive the growth factors. Appendix F in the same document provides the cross references of livestock sources in the ag, afdust and ptnonipm sectors to the animal categories in Table 3-3.

Table 3-3. Growth factors from year 2005 to future years for Animal Operations

Animal Category	2016 Projection Factors
Dairy Cow	1.000
Beef	1.019
Pork	1.083
Broilers	1.321
Turkeys	1.000
Layers	1.224
Poultry Average	1.250
Overall Average	1.087

3.2.2 Residential wood combustion growth (nonpt)

We projected residential wood combustion emissions based on the expected increase in the number of low-emitting wood stoves and the corresponding decrease in other types of wood stoves. As newer, cleaner woodstoves replace older, higher-polluting wood stoves, there will be an overall reduction of the emissions from these sources. The approach and values cited here was developed with assistance from the EPA team working on the woodstoves change-out program. They worked with the Hearth, Patio, and Barbecue Association to see what the best-available data were for projecting this sector into the future.

The specific assumptions we made were:

- Fireplaces, SCC=2104008001: increase 1%/year
- Old woodstoves, SCC=2104008002, 2104008010, or 2104008051: decrease 2%/year
- New woodstoves, SCC=2104008003, 2104008004, 2104008030, 2104008050, 2104008052 or 2104008053: increase 2%/year

For the general woodstoves and fireplaces category (SCC 2104008000) we computed a weighted average distribution based on 19.4% fireplaces, 71.6% old woodstoves, 9.1% new woodstoves using 2002v3 Platform (these emissions have not been updated for the 2005v4 platform used for the Transport Rule proposal) emissions for $PM_{2.5}$. These fractions are based on the fraction of emissions from these processes in the states that did not have the “general woodstoves and fireplaces” SCC in the 2002v3 NEI. This approach results in an overall decrease of 1.056% per year for this source category.

Table 3-4 presents the projection factors used to project the 2005 base case (2002 emissions) for residential wood combustion.

Table 3-4. Projection Factors for growing year 2005 Residential Wood Combustion Sources to 2016

SCC	SCC Description	Projection Factors 2016
2104008000	Total: Woodstoves and Fireplaces	0.8522
2104008001	Fireplaces: General	1.1400
2104008070	Outdoor Wood Burning Equipment	
2104008002	Fireplaces: Insert; non-EPA certified	0.7200
2104008010	Woodstoves: General	
2104008051	Non-catalytic Woodstoves: Non-EPA certified	
2104008003	Fireplaces: Insert; EPA certified; non-catalytic	1.28
2104008004	Fireplaces: Insert; EPA certified; catalytic	
2104008030	Catalytic Woodstoves: General	
2104008050	Non-catalytic Woodstoves: EPA certified	
2104008052	Non-catalytic Woodstoves: Low Emitting	
2104008053	Non-catalytic Woodstoves: Pellet Fired	

3.2.3 Gasoline Stage II growth and control (nonpt, ptnonipm)

Emissions from Stage II gasoline operations in the 2005 base case are contained in both nonpt and ptnonipm sectors. The only SCC in the nonpt inventory used for gasoline Stage II emissions is 2501060100 (Storage and Transport; Petroleum and Petroleum Product Storage; Gasoline Service Stations; Stage II: Total). The following SIC and SCC codes are associated with gasoline Stage II emissions in the ptnonipm sector:

- SIC 5541 (Automotive Dealers & Service Stations, Gasoline Service Stations, Gasoline service stations)
- SCC 40600401 (Petroleum and Solvent Evaporation;Transportation and Marketing of Petroleum Products;Filling Vehicle Gas Tanks - Stage II;Vapor Loss w/o Controls)
- SCC 40600402 (Petroleum and Solvent Evaporation;Transportation and Marketing of Petroleum Products;Filling Vehicle Gas Tanks - Stage II;Liquid Spill Loss w/o Controls)
- SCC 40600403 (Petroleum and Solvent Evaporation;Transportation and Marketing of Petroleum Products;Filling Vehicle Gas Tanks - Stage II;Vapor Loss w/o Controls)
- SCC 40600499 (Petroleum and Solvent Evaporation;Transportation and Marketing of Petroleum Products;Filling Vehicle Gas Tanks - Stage II;Not Classified

We used a consistent approach across nonpt and ptnonipm to project these gasoline stage II emissions. The approach involved computing VOC-specific projection factors from the NMIM results for onroad refueling, using ratios of future–year emissions to 2005 base-case emissions. The approach accounts for three elements of refueling growth and control: (1) activity growth (due to VMT growth as input into NMIM), (2) emissions reductions from Stage II control programs at gasoline stations, and (3) emissions reductions resulting from the phase-in over time of newer vehicles with onboard Stage II vehicle controls. We assumed that all areas with Stage II controls in 2005 continue to have Stage II controls in 2016.

We computed VOC, benzene and naphthalene projection factors at a county-specific, annual resolution as shown below:

$PF_{[county, future year]} = VOC\_RFL_{[county, future year]}/VOC\_RFL_{[county, 2005]}$
$PF_{[county, future year]} = BENZENE\_RFL_{[county, future year]}/ BENZENE\_RFL_{[county, 2005]}$
$PF_{[county, future year]} = NAPHTHALENE\_RFL_{[county, future year]}/ NAPHTHALENE\_RFL_{[county, 2005]}$

Where VOC_RFL is the VOC refueling emissions for onroad sources from NMIM,
BENZENE_RFL is the BENZENE refueling emissions for onroad sources from NMIM, and
NAPHTHALENE_RFL is the NAPHTHALENE refueling emissions for onroad sources from NMIM.

For this 2016 projection, we obtained VOC_RFL, BENZENE_RFL and NAPHTHALENE_RFL for each county by interpolating 2015 and 2020 NMIM results.

We applied these projection factors to both nonpt and ptnonipm sector gasoline stage II sources.

Chemical speciation uses certain VOC HAPs for some sources, specifically, benzene, acetaldehyde, formaldehyde, and methanol (BAFM). The VOC HAPs are used for sources that have consistent VOC and VOC HAPs using various criteria as described in the 2005 v4.1 platform documentation, and these sources are called "integrated" sources. The nonpoint gasoline stage II emissions are an integrated source, and so the VOC HAPs are also projected based on ratios of future year and base year VOC. The only two VOC HAPs emitted from refueling are benzene and naphthalene, and both of these were projected consistently with VOC. However, naphthalene was not used in the chemical speciation (it is not B,A,F or M) and was therefore not used for this effort. Benzene was used as part of the speciation for the nonpt sector gasoline stage II sources. The ptnonipm is a "no-integrate" sector, so ptnonipm gasoline stage II sources did not use the projected benzene as part of the speciation, but rather used VOC speciation to estimate benzene.

3.2.4 Portable fuel container growth and control (nonpt)

We obtained future-year VOC emissions from Portable Fuel Containers (PFCs) from inventories developed and modeled for EPA‟s MSAT rule (EPA, 2007b). The 10 PFC SCCs are summarized below (full SCC descriptions for these SCCs include "Storage and Transport; Petroleum and Petroleum Product Storage" as the beginning of the description) below.

- 2501011011 Residential Portable Fuel Containers: Permeation
- 2501011012 Residential Portable Fuel Containers: Evaporation
- 2501011013 Residential Portable Fuel Containers: Spillage During Transport
- 2501011014 Residential Portable Fuel Containers: Refilling at the Pump: Vapor Displacement
- 2501011015 Residential Portable Fuel Containers: Refilling at the Pump: Spillage
- 2501012011 Commercial Portable Fuel Containers: Permeation
- 2501012012 Commercial Portable Fuel Containers: Evaporation
- 2501012013 Commercial Portable Fuel Containers: Spillage During Transport
- 2501012014 Commercial Portable Fuel Containers: Refilling at the Pump: Vapor Displacement
- 2501012015 Commercial Portable Fuel Containers: Refilling at the Pump: Spillage

Additional information on the PFC inventories is available in Section 2.2.3 of the documentation for the 2002 Platform (Clearinghouse for Inventories and Emissions Factors (CHIEF)).

The future-year emissions reflect projected increases in fuel consumption, state programs to reduce PFC emissions, standards promulgated in the MSAT rule, and impacts of the Renewable Fuel Standard (RFS) on gasoline volatility. Future-year emissions for PFCs were available for 2010, 2015, 2020, and 2030. In creating the inventories for 2016, we linearly interpolated year 2015 and year 2020 inventories. Benzene and other VOC HAP future-year PFC emissions were also included in the interpolation. Benzene was used in VOC speciation for CMAQ through the modification of VOC speciation profiles calculations (no other BAFM HAPs are emitted from PFCs).

3.2.5 Aircraft growth (ptnonipm)

As with the 2005v4 platform, aircraft emissions are contained in the ptnonipm inventory. These 2005 point source emissions are projected to future years by applying activity growth using data on itinerant (ITN) operations at airports. The ITN operations are defined as aircraft take-offs whereby the aircraft leaves the airport vicinity and lands at another airport, or aircraft landings whereby the aircraft has arrived from outside the airport vicinity. We used projected ITN information available from the Federal Aviation Administration's (FAA) Terminal Area Forecast (TAF) System (publication date December 2008). This information is available for approximately 3,300 individual airports, for all years up to 2025. We aggregated and applied this information at the national level by summing the airport-specific (U.S. airports only) ITN operations to national totals by year and by aircraft operation, for each of the four available operation types: commercial, general, air taxi, military. We computed growth factors for each operation type by dividing future-year ITN by 2005-year ITN. We assigned factors to inventory SCCs based on the operation type.

The methods that the FAA used for developing the ITN data in the TAF are documented.

Table 3-5 provides the national growth factors for aircraft; all factors are applied to year 2005 emissions. For example, year 2016 commercial aircraft emissions are 11.18% higher than year 2005 emissions.

Table 3-5. Factors used to project base case 2005 aircraft emissions to future years

SCC	SCC Description	Year 2016 factor
2275001000	Military aircraft	0.968
2275020000	Commercial aircraft	1.1118
2275050000	General aviation	0.9952
2275060000	Air taxi	0.9235
27501015	Internal Combustion Engines; Fixed Wing Aircraft L & TO Exhaust;Military;Jet Engine: JP-5	0.968
27502001	Internal Combustion Engines; Fixed Wing Aircraft L & TO Exhaust;Commercial;Piston Engine: Aviation Gas	1.1118
27502011	Internal Combustion Engines; Fixed Wing Aircraft L & TO Exhaust;Commercial;Jet Engine: Jet A	1.1118
27505001	Internal Combustion Engines; Fixed Wing Aircraft L & TO Exhaust;Civil;Piston Engine: Aviation Gas	0.9952
27505011	Internal Combustion Engines; Fixed Wing Aircraft L & TO Exhaust;Civil;Jet Engine: Jet A	0.9952
27601014	Internal Combustion Engines; Rotary Wing Aircraft L & TO Exhaust;Military;Jet Engine: JP-4	0.968
27601015	Internal Combustion Engines; Rotary Wing Aircraft L & TO Exhaust;Military;Jet Engine: JP-5	0.968

We did not apply growth factors to any point sources with SCC 27602011 (Internal Combustion Engines; Rotary Wing Aircraft L & TO Exhaust; Commercial; Jet Engine: Jet A) because the plant names associated with these point sources appeared to represent industrial facilities rather than airports. This SCC is only in one county, Santa Barbara, California (State/County FIPS 06083).

None of our aircraft emission projections account for any control programs. We considered the NO_X standard adopted by the International Civil Aviation Organization's (ICAO) Committee on Aviation Environmental Protection (CAEP) in February 2004, which is expected to reduce NO_X by approximately 2% in 2015 and 3% in 2020. However, this rule has not yet been adopted as an EPA (or U.S.) rule; therefore, the effects of this rule were not included in the future-year emissions projections.

3.2.6 Stationary Source control programs, consent decrees & settlements, and plant closures (ptnonipm, nonpt)

We applied emissions reduction factors to the 2005 emissions for particular sources in the ptnonipm and nonpt sectors to reflect the impact of stationary-source control programs including consent decrees, settlements, and plant closures. Here we describe the complete contents of the controls and closures for the 2016 base cases.

Controls from the NO_X SIP call were assumed to have been implemented by 2005 and captured in the 2005 base case (2005v2 point inventory). This assumption was confirmed by review of the 2005 NEI that showed reductions from Large Boiler/Turbines and Large Internal Combustion Engines in the Northeast states covered by the NOx SIP call. The future-year base controls consist of the following:

- We did not include MACT rules where compliance dates were prior to 2005, because we assumed these were already reflected in the 2005 inventory. The EPA OAQPS Sector Policies and Programs Division (SPPD) provided all controls information related to the MACT rules, and this information is as consistent as possible with the preamble emissions reduction percentages for these rules.
- We included plant closures (i.e., emissions were zeroed out for future years) where information indicated that the plant was actually closed. However, plants projected to close in the future (post-2008) were not removed in the future years because these projections can be inaccurate due to economic improvements. Not including cement kiln and plant closures discussed later in Section 3.2.6.1, we also applied plant closures listed in Appendix E. The magnitude of these non-cement plant closures is shown in Table 3-6 below.

Table 3-6. Summary of Emission Reductions Applied to the 2005 Base Year Inventory Due To Plant Closures

State	CO (tons)	NH_3 (tons)	NO_X (tons)	PM_{10} (tons)	$PM_{2.5}$ (tons)	SO_2 (tons)	VOC (tons)	HG (tons)	CL2 (tons)	HCL (tons)
Alabama	7,649	6	153	1,885	1,708	594	571	0.0250		
Florida	28	230	461	252	159	8,469		0.0045		
Georgia	1,751		60	41	27	482				
Illinois*	187		2,452	726	640	19,572	517	0.0134		206
Indiana	438	0	541	193	82	4,530	94	0.0094		9.21
Iowa	374		789	213	37	3,227	10	0.00023		
Louisiana	3,035	127	1,878	1,026	787	4,114	4,061	0.0013	0.001	39.03
Maine	35	12	1,145	340	143	3,572	146	0.00095		
Massachusetts	32	6	385	68	35	1,303	39	0.00028		
Michigan	1,366	4	2,606	509	332	2,076	398	0.034	0.16	99.07
New Hampshire	101		212	75	65	669	10	0.015	0.02	0.50
New York	5	1	48	16	11	217	14	7.9E-5		
North Carolina	12	1	94	25	17	379	7	0.00017		
Ohio	29		809	74	32	6,705	4	0.0048		72.98
Tennessee	47	0	2,057	169	94	5,377	9,059	0.012	0.005	91.10
Texas	220		71	38	35	35	18			
West Virginia	3,770	1	498	48	46	4,893	207			
Wisconsin	479	28	1,953	436	297	7,672	349	0.0063		96.66
Grand Total	19,557	415	16,213	6,135	4,546	73,886	15,504	0.1275	0.18	614.54

* For one "closure" in Illinois, we added in 2008 emissions due to a replacement of several units with a new PSD unit. The added emissions are: 246 tons CO, 0.52 tons NH3, 719.3 tons NOX, 515 tons PM10, 418 tons PM2.5 and 2,203 tons SO2 and 100 tons HCL.

We inadvertently did not apply the plant closures that were included for the proposed Transport Rule because of technical difficulties with software. These proposed transport rule closures affect the following sources: auto plants, pulp and paper plants, large and small municipal waste combustors (LMWC and SMWC), as well as plants closed before 2008 but following the release of the 2005v2 point inventory. The EPA OAQPS SPPD provided the closures information. The impact of not applying the additional closures is shown below in Table 3-7.

Table 3-7. Quantification of Missing Closures in 2016 the non-EGU (ptnonipm) sector

State	Pollutant	non-EGU emissions without closures (tons)	non-EGU emissions with closures (tons)	Excess emissions (tons)	Percent Overestimate in Total man-made Emissions
Georgia	VOC	33,214	31,572	1,642	0.4%
Illinois	CO	85,413	85,305	109	0%
Michigan	NO_X	78,730	78,566	164	0%
Missouri	VOC	20,067	19,775	291	0.1%
New Jersey	VOC	11,226	10,230	996	0.5%
Pennsylvania	NO_X	76,953	76,749	204	0%
Pennsylvania	SO_2	46,609	46,231	378	0.1%
South Carolina	NO_X	27,793	27,675	119	0.1%
South Carolina	VOC	17,132	16,928	204	0.1%
Tennessee	NO_X	49,456	49,284	172	0%
West Virginia	NO_X	32,180	31,463	717	0.5%
West Virginia	SO_2	23,305	21,701	1,604	1.0%
West Virginia	VOC	11,879	11,678	201	0.2%

- In addition to plant closures, we included the effects of the Department of Justice Settlements and Consent Decrees on the non-EGU (ptnonipm) sector emissions. We also included estimated impacts of HAP standards per Section 112, 129 of the Clean Air Act on the non-EGU (ptnonipm) and nonpoint (nonpt) sector emissions, based on expected CAP co-benefits to sources in these sectors.
- Numerous controls have compliance dates beyond 2008; these include refinery and the Office of Compliance and Enforcement (OECA) consent decrees, Department of Justice (DOJ) settlements, as well as most national VOC MACT controls. Additional OECA consent decree information is provided in Appendix C, and the detailed data used are available at the website listed in Section 1.
- The EPA OAQPS SPPD provided refinery consent decrees controls at the facility and SCC level.
- We applied most of the control programs as replacement controls, which means that any existing percent reductions ("baseline control efficiency") reported in the NEI were removed prior to the addition of the percent reductions due to these control programs. Exceptions to replacement controls are "additional" controls, which ensure that the controlled emissions match desired reductions regardless of the baseline control efficiencies in the NEI. We used the "additional controls" approach for many settlements and consent decrees where specific plant and multiple-plant-level reductions/targets were desired and at municipal waste landfills where VOC was reduced 75% via a MACT control using projection factors of 0.25.
- We applied New York State Implementation Plan available controls for the 1997 8-hour Ozone standard for non-EGU point and nonpoint NO_X and VOC sources based on NY State Department of Environmental Conservation February 2008 guidance. These reductions are found in Appendix J in: Section 3.2.6.

3.2.6.1 Reductions from the Portland Cement NESHAP

As indicated in Table 3-1, the Industrial Sectors Integrated Solutions (ISIS) model (EPA, 2010b) was used to project the cement industry component of the ptnonipm emissions modeling sector to 2016. This approach provided reductions of criteria and hazardous air pollutants, including mercury. The ISIS cement emissions were developed in support for the Portland Cement NESHAPs and the NSPS for the Portland cement manufacturing industry.

The ISIS model produced a Portland Cement NESHAP policy case of multi-pollutant emissions for individual cement kilns (emission inventory units) that were relevant for years 2013 through 2017. These ISIS-based emissions included information on new cement kilns, facility and unit-level closures, and updated policy case emissions at existing cement kilns.

The ISIS model results for the future show a continuation of the recent trend in the cement sector of the replacement of lower capacity, inefficient wet and long dry kilns with bigger and more efficient preheater and precalciner kilns. Multiple regulatory requirements such as the NESHAP and NSPS currently apply to the cement industry to reduce CAP and HAP emissions. Additionally, state and local regulatory requirements might apply to individual cement facilities depending on their locations relative to ozone and $PM_{2.5}$ nonattainment areas. The ISIS model provides the emission reduction strategy that balances: 1) optimal (least cost) industry operation, 2) cost-effective controls to meet the demand for cement, and 3) emission reduction requirements over the time period of interest. Table 3-8 shows the magnitude of the ISIS-based cement industry reductions in the future-year emissions that represent 2016, and the impact that these reductions have on total stationary non-EGU point source (ptnonipm) emissions.

Table 3-8. Future-year ISIS-based cement industry annual reductions (tons/yr) for the non-EGU (ptnonipm) sector

Pollutant	Cement Industry emissions in 2005	Decrease in cement industry emissions in 2016 vs 2005	% decrease in ptnonipm from cement reduction
NO_X	193,000	56,740	2.4%
$PM_{2.5}$	14,400	7,840	1.8%
SO_2	128,400	106,000	5.0%
VOC	6,900	5,570	0.4%
HCL	2,900	2,220	4.5%
Hg	8.87	6.63	15.2%

3.2.6.2 Boiler MACT reductions

We applied emission reductions to boilers in the ptnonipm sector based on the Boiler MACT proposal, with additional adjustments that made it similar to the final Boiler MACT. In particular, we applied reductions to (1) boilers in the inventory that could be matched to facility/fuel (2005 NEI NEI_UNIQUE_ID and SCC fields) combinations in the ICR data and (2) boilers in the inventory that were not in the Boiler MACT ICR database, but that the Boiler MACT project team indicated were part of the category.

Different approaches were used for applying the reductions for mercury versus the other pollutants because the mercury emissions from the ICR were used directly in the ptnonipm sector, whereas the other pollutants used the 2005v2 NEI data[2].

For mercury, the Boiler MACT ICR-based unit-level emissions inventory, using facility and unit IDs from the boiler MACT ICR database, was incorporated into the base-case 2005 ptnonipm sector. Modeling parameters such as geographic coordinates and stack parameters were obtained by matching the facilities in the Boiler MACT ICR database to the facilities in the NEI and NATA inventories (details are provided in the

[2] This approach was based on exploring the sources of the NEI versus ICR data, particularly the SO_2 values. We determined that a large portion of the ICR data utilized average emission factor that did not account for the sulfur content of the fuel nor any permit limitations that could impact emissions. Also, for boilers with CEMs, the boiler ICR utilized a month or two of CEM data whereas the NEI emissions (primarily state reported data) uses the entire year of CEM data where available.

2004v4.1 platform documentation). The amount of mercury from facilities that did not match summed to 0.177 tons (about 4%); these facilities were not included in base-case 2005 ptnonipm sector. For the units included in the sector, we applied unit-specific reductions provided by the rule developers to the ICR-based base-case emissions. These reductions were provided to a modified database developed between the proposal and final rule.

In addition, we applied Hg reductions to boilers at 18 additional facilities (that were not included in the Boiler MACT ICR data) in consultation with the rule developers, resulting in an additional 0.013 tons of Hg reductions. These reductions were applied by facility and fuel type. A default percent reduction was used for these sources, which we computed for each fuel type from the unit-specific reductions. We used the mode of the data (i.e., most frequent data value), excluding zeros. These values along with the modal values for the other pollutants are shown in Table 3-9. The non-Hg pollutants also used the mode of the reductions in the ICR data as the percent reduction.

Table 3-9. Default pollutant fuel reductions applied NEI boilers not covered by the ICR database.

Fuel	SO_2 % reduction	VOC % reduction	$PM_{2.5}$ % reduction	CO % reduction	HCL % reduction	Hg % reduction
coal	95	89	59	89	82	62
gas 1 (other)	1	1	1	1	1	1
gas 2	95	98	0	98.1	99.76	82
bagasse	95	73	89	73	41	76
dry biomass	95	10.5	94	10.5	22	8
Gas 1 (NG)	1	1	1	1	1	n/a
heavy liquid	95	99.1	94.5	99.1	86.96	1
light liquid	95	99.95	80.5	99.9	68.5	1
wet biomass	95	39	75	38.5	11.5	34

In addition to the Hg reductions, we reduced SO_2, $PM_{2.5}$, CO and VOC using facility-fuel based reduction information from the Boiler MACT ICR database. Because we were unable to match the specific units from the Boiler MACT ICR to the units in the 2005 inventory, we used the following approach. First we matched the 2005 inventory and the Boiler MACT ICR data at the facility (NEI_UNIQUE_ID) level. At the facility level, we were able to match facilities that captured 97% of the total Boiler MACT ICR data SO_2 emissions. For facilities that matched, we applied the Boiler MACT ICR reductions only to inventory boiler processes from these facilities that have the same fuel type (per the SCC description) as the fuel listed in the ICR Boiler MACT database. Because the ICR fuel types do not match the fuel definitions in the inventory, we used a cross walk to match the ICR and inventory fuels, shown below in Table 3-10. For some NEI fuels, we allowed two possibilities for ICR fuels to match to address the potential overlap of multiple ICR fuel categories and to increase the number of facility/processes in the NEI that matched units in the ICR database. The second choice was only used when units in the ICR database did not match any units in the inventory at that facility.

Table 3-10. Crosswalk of NEI fuels to ICR fuels

Inventory fuel category	ICR fuel category, 1st choice	ICR fuel category, 2nd choice
Bagasse	Bagasse	
Coal	Coal	

Inventory fuel category	ICR fuel category, 1st choice	ICR fuel category, 2nd choice
Coal-based Synfuel	Heavy Liquid	Light Liquid
Crude oil	Heavy Liquid	
Digester Gas	Gas 2	
Distillate Oil	Light Liquid	
Distillate Oil (Diesel)	Light Liquid	
Gas	Gas 2	
Gasified Coal	Gas 1 (Other)	Gas 2
Gasoline	Light Liquid	Heavy Liquid
Hydrogen	Gas 1 (Other)	
Kerosene	Light Liquid	
Kerosene/Naphtha (Jet Fuel)	Light Liquid	
Landfill Gas	Gas 2	
Liquid Waste	Heavy Liquid	Heavy Liquid
Liquified Petroleum Gas (LPG)	Gas 1 (Other)	
LPG	Gas 1 (Other)	
Methanol	Heavy Liquid	
Natural Gas	Gas 1 (NG Only)	
Oil	Light Liquid	Heavy Liquid
Other Oil	Light Liquid	Heavy Liquid
Petroleum Coke	Coal	
Process Gas	Gas 2	
propane/butane	Gas 1 (Other)	
Refinery Gas	Gas 1 (Other)	
Residual Oil	Heavy Liquid	
Solid Waste	Wet Biomass	Dry Biomass
Unknown	Gas 1 (NG Only)	Petroleum industry process heater, (SCC 30600199)
Waste Coal	Coal	
Waste oil	Heavy Liquid	Light Liquid
Wood	Dry Biomass	Wet Biomass
Wood/Bark Waste	Wet Biomass	Dry Biomass

Unit- and pollutant-specific reductions from the ICR database were applied to the records in the inventory that matched facility and fuel type for boilers and process heaters. In addition, default reductions were applied, based on Table 3-9, to units at the 18 facilities which were not in the Boiler MACT ICR, but were determined to be part of the Boiler MACT category.

The resulting emissions reductions from the boiler MACT are shown in Table 3-11. The reduction of 1.75 tons of mercury shown in the table is fairly consistent with the 1.45 ton mercury reduction cited by the final Major and Area Boiler MACT Rules, especially considering that the rule was several months away from finalization when these emissions projections were done. The Boiler MACT proposal cited 8.25 tons of reductions from these rules. Any inconsistencies with emissions reductions cited by the Boiler MACT Final Rules are the result of different base emissions assumptions for these pollutants.

Table 3-11. Summary of Boiler MACT reductions applied to the ptnonipm sector.

Pollutant	Modeled Boiler MACT reductions (tons)
Mercury	1.75
SO_2	391,000
$PM_{2.5}$	17,000
VOC	3,000
CO	72,000
HCL	5,600

3.2.6.3 Boiler reductions not associated with the MACT rule

The Boiler MACT ICR collected data on existing controls. We used an early version of the data base entitled "survey_database_2008_results2.mdb" (EPA-HQ-OAR-2002-0058-0788) which is posted under the Technical Information for the Boiler MACT major source rule. We extracted all controls that were installed after 2005, determined a percent reduction, and verified that these controls were being used. In many situations we were told that the controls were on site but were not being utilized. As a result, plant-unit specific reductions resulted in the state-level changes summarized in Table 3-12.

Table 3-12. State-level non-MACT Boiler Reductions from ICR Data Gathering

State	Pollutant	Pre-controlled Emissions (tons)	Controlled Emissions (tons)	Reductions (tons)	Percent Reduction %
Michigan	NO_X	907	544	363	40
North Carolina	SO_2	652	65	587	90
Virginia	SO_2	3379	338	3041	90
Washington	SO_2	639	383	256	40
North Carolina	HCL	31	3	28	90

3.2.6.3 Summary of Mercury Reductions at non-EGU stationary sources- (ptnonipm)

The mercury emission projections included NESHAP for non-EGU source categories that were finalized or expected to be finalized prior to the proposed Toxics rule including the Boiler MACT (1.75 tons reduction), Portland Cement NESHAP (6.4 tons reduction), Gold Mines NESHAP (1.8 tons reduction), Electric Arc Furnaces NESHAP (2.4 tons reduction), Mercury Cell Chlor-Alkali NESHAP (2.8 tons reduction) and Hazardous Waste Combustion NESHAP (1.1 ton reduction[3]) In addition, the projections included reduction of Hg emissions (0.7 ton reduction) due to the replacement of a smelter with a recovery boiler at a pulp and paper plant. Table 3-13 provides a summary of key mercury sectors and their 2005 and 2016 emissions.

[3] Actual reduction for hazardous waste reduction should have been 0.2 tons, but due to an error in the percentage applied, a higher value was reduced.

Table 3-13. Anthropogenic mercury emissions and projections in the Continental United States

Category	2005 Mercury (tons)	2016 Mercury (tons)
Electric Generating Units	52.9	28.7*
Portland Cement Manufacturing	7.5	1.1
Stainless and Nonstainless Steel Manufacturing: Electric Arc Furnaces	7.0	4.6
Industrial, Commercial, Institutional Boilers & Process Heaters	6.4	4.6
Chemical Manufacturing	3.3	3.3
Hazardous Waste Incineration	3.2	2.1
Mercury Cell Chlor-Alkali Plants	3.1	0.3
Gold Mining	2.5	0.7
Municipal Waste Combustors	2.3	2.3
Sum of other source categories (each of which emits less than 2 tons)	17	16
Total	**105**	**64**
*The EGU emissions utilize the interim IPM4.10, which were used in the Air Quality Modeling. The final IPM future year base case Hg total is 24.9 tons.		

Reductions from Portland Cement and Boiler MACT were discussed above. The Gold Mine reductions were provided by the SPPD project lead and are summarized in Appendix C.

Appendix F details the source of the data used for the reductions for Electric Arc Furnaces NESHAP, Mercury Cell Chlor-Alkali NESHAP, Hazardous Waste Combustion, the pulp and paper plant reduction, and methodology used to apply them.

3.2.7 Oil and gas projections in TX, OK, and non-California WRAP states (nonpt)

For the 2005v4.1 platform, we received updated 2005 oil and gas emissions from Texas and Oklahoma. We also received 2008 data that we used for 2016, because it was the best available data to represent 2016.

We applied emissions reductions from the Stationary Reciprocating Internal Combustion Engine (RICE) NESHAP, which we assumed has some applicability to this industry (see Appendix F). We applied these reductions of CO, NO_X, and VOC to the 2008 Texas and Oklahoma data. SO_2 reductions associated with the RICE NESHAP were not included due to lack of time to include. They would impact 2310000220 (Industrial Processes; Oil and Gas Production: SIC 13; Drill rigs) for which we estimate a reduction in 2005 emissions of about 4400 tons, nationwide.

We discovered after emissions processing was complete, that 2016 drill rig emissions estimates were available for each year for TX. These correct 2016 emissions, provided by the Texas Commission on Environmental Quality (TCEQ) are shown in Table 3-14 along with Oklahoma data for 2005, 2008, and adjusted 2008 using the RICE reductions, which were used for 2016.

Table 3-14. 2005, 2008 and estimated 2016 emissions for nonpoint Oklahoma and Texas oil and gas sources

	Oklahoma			Texas			
	2005 (tons)	**2008 (tons)**	**2016* (tons)**	**2005 (tons)**	**2008 (tons)**	**2016* (tons)**	**2016 TCEQ** estimate (tons)**
CO	32,821	32,830	31,484	15,878	13,400	10,079	11,558
NO_X	39,668	42,402	39,808	42,854	48,317	41,395	36,440
VOC	155,908	163,598	163,209	4,337	4,326	4,326	3,320
SO_2	1,014	2	2	5,977	956	956	37
PM_{10}	1,918	2,231	2,231	3,036	2,543	2,543	1,320
$PM_{2.5}$	1,918	2,231	2,231	2,945	2,467	2,467	1,280

* 2016 emissions estimated as 2008 emissions with RICE reductions, which affects only CO, NO_X, and VOC
** Table 1.1.

As with the 2005 v4 platform, the v4.1 platform utilizes the Phase II WRAP oil and gas emissions data for the non-California Western Regional Air Partnership (WRAP) states for 2005. However, unlike the projection methodology used for the proposed Transport Rule, in which we used the 2005 for both 2005 and the future years (which were 2012 and 2014), we were able to obtain the WRAP 2018 Phase II emissions for 2016 for the Proposed Toxics Rule. These data became available in time for us to incorporate them into this platform, and were the best available data to represent 2016. Like the Texas and Oklahoma data, we applied RICE reductions to the 2018 WRAP data for use in 2016. Table 3-15 shows the WRAP oil and gas emissions in 2005, and future year, before and after the RICE reductions. The emissions used in 2016 are the 2018 WRAP-supplied emissions with the RICE reductions applied.

Table 3-15. WRAP Oil and Gas Emissions: 2005, 2018 WRAP, and 2016 with additional reductions due to the RICE NESHAP

	CO (tons)			NOX (tons)			VOC (tons)			SO2 (tons)*	
State	**2005**	**2018 WRAP**	**2016***	**2005**	**2018 WRAP**	**2016***	**2005**	**2018 WRAP**	**2016***	**2005**	**2016***
Alaska	0	0	0	836	453	396	68	12	12	62	1
Arizona	1	2	2	13	15	14	37	49	49		
Colorado	9,134	9,661	8,785	32,188	33,517	32,412	35,500	43,639	43,285	350	11
Montana	1,159	1,542	1,541	10,617	13,880	13,032	9,187	14,110	14,009	640	6
Nevada	0	0	0	71	63	55	105	163	163	1	0
New Mexico	32,004	44,011	36,251	61,674	74,648	67,984	215,636	267,846	266,681	369	12
North Dakota	38	172	172	6,040	20,869	18,356	8,988	17,968	17,968	688	4
Oregon	2	2	2	61	44	40	19	14	14		
South Dakota	15	16	16	566	557	496	370	562	562	43	0
Utah	1,426	1,347	1,305	6,896	6,297	6,158	43,403	81,890	81,869	149	1
Wyoming	10,004	8,540	7,807	36,172	34,142	32,695	166,939	304,748	304,637	541	3
Grand Total	**53,784**	**65,292**	**55,880**	**155,133**	**184,486**	**171,640**	**480,252**	**731,002**	**729,250**	**2,842**	**39**

* 2016 emissions are 2018 WRAP emissions with RICE NESHAP reductions. These reductions apply only to CO, NO_X, and VOC.

3.2.8 Future Year VOC Speciation for gasoline-related sources (ptnonipm, nonpt)

To account for the future projected increase in the ethanol content of fuels, we used different future-year VOC speciation for certain gasoline-related emission sources. Such sources include gasoline stage II, portable fuel containers (PFCs), and finished fuel storage and transport-related sources related to bulk terminals (where the ethanol may be mixed) and downstream to the pump. We identified this last group of sources as “btp” (from bulk terminals to pumps). While most of these sources are in the nonpt sector, there are also some in the ptnonipm sector. In the 2005 base year we used zero percent ethanol (E0) fuel profiles; however, for the 2016 profiles we used combinations of E0 and ten percent ethanol (E10) fuel profiles. The fuel type fraction was developed based on the Department of Energy Annual Energy Outlook (AEO) 2007 projections of ethanol fuels for the year 2022. In the AEO 2007 data, the proportions of E0 and E10 fuels are the same for 2012 and years beyond (even though the quantities of the two fuels change over these years). The national level proportions were allocated to counties across the country using fuel modeling at the EPA Office of Transportation and Air Quality. All gasoline stage II and “btp” sources used the same combination of E0 and E10 headspace profiles as were used for exhaust and evaporative profiles.

3.3 Mobile source projections

Mobile source monthly inventories of onroad and nonroad mobile emissions were created for 2016 using a combination of the NMIM and MOVES2010 models. Future-year emissions reflect onroad mobile control programs including the Light-Duty Vehicle Tier 2 Rule, the Onroad Heavy-Duty Rule, and the Mobile Source Air Toxics (MSAT2) final rule. Nonroad mobile emissions reductions for these years include reductions to locomotives, various nonroad engines including diesel engines and various marine engine types, fuel sulfur content, and evaporative emissions standards.

Onroad mobile sources are comprised of several components and are discussed in the next subsection (3.3.1). Monthly nonroad mobile emission projections are discussed in subsection 3.3.2. Locomotives and Class 1 and Class 2 commercial marine vessel (C1/C2 CMV) projections are discussed in subsection 3.3.3, and Class 3 (C3) CMV projected emissions are discussed in subsection 3.3.4.

3.3.1 Onroad mobile (on_noadj, on_moves_runpm, on_moves_startpm)

The onroad emissions were primarily based on the 2010 version of the Motor Vehicle Emissions Simulator (MOVES2010) – the same version as was used for 2005. The same MOVES-based $PM_{2.5}$ temperature adjustment factors were applied as were used in 2005 for running mode emissions; however, cold start emissions used year-specific temperature adjustment factors. The temperature adjustments have the minor limitation that they were based on the use of MOVES national default inputs rather than county-specific inputs, because a county-specific database for input to MOVES was not available at the time this approach was needed. However, the $PM_{2.5}$ temperature adjustments are fairly insensitive to the county-specific inputs, which is why this is only a minor limitation. Mercury was the only onroad HAP used in 2016 that did not come from MOVES, since the capability for mercury from MOVES was not available at the time this work was completed. For mercury, we used the 2005 NMIM-based emissions for 2016.

<u>California onroad</u> (on_noadj)

Like year 2005 emissions, future-year California NH_3 emissions are from MOVES runs for California, disaggregated to the county level using NMIM. For all other pollutants, we did not use MOVES to generate future-year onroad emissions for California, because the 2005 base year emissions were provided by CARB‟s Emission Factors mobile model (EMFAC), which CARB submitted for the 2005 NEI. For California, we chose an approach that would maintain consistency between the 2005 and 2016 emissions.

This approach involved computing projection factors from a consistent set of future and 2005-year data based on the EMFAC2007 model provided by CARB. We generated projection factors by dividing the EMFAC2007-based emissions for 2016 (linearly interpolated between year 2014 and year 2020) by the EMFAC2007-based emissions for 2005. These EMFAC-based emissions were provided in March 2007. California does not specify road types, so we first used NMIM California ratios to break out vehicle emissions to the match the more detailed NMIM level before projecting to 2016.

HAP emissions were computed as 2005v2-based HAP-CAP ratios applied at the pollutant and Level 3 SCC (first 7 characters) to 2016 CAP emissions. HAPs were scaled to either of three pollutants: exhaust $PM_{2.5}$ (e.g., metals), exhaust VOC (e.g., exhaust mode VOC HAPs such as acetaldehyde and formaldehyde), or evaporative VOC (e.g., evaporative mode VOC HAPs such as benzene).

<u>MOVES-based no-adjust</u> (on_noadj)

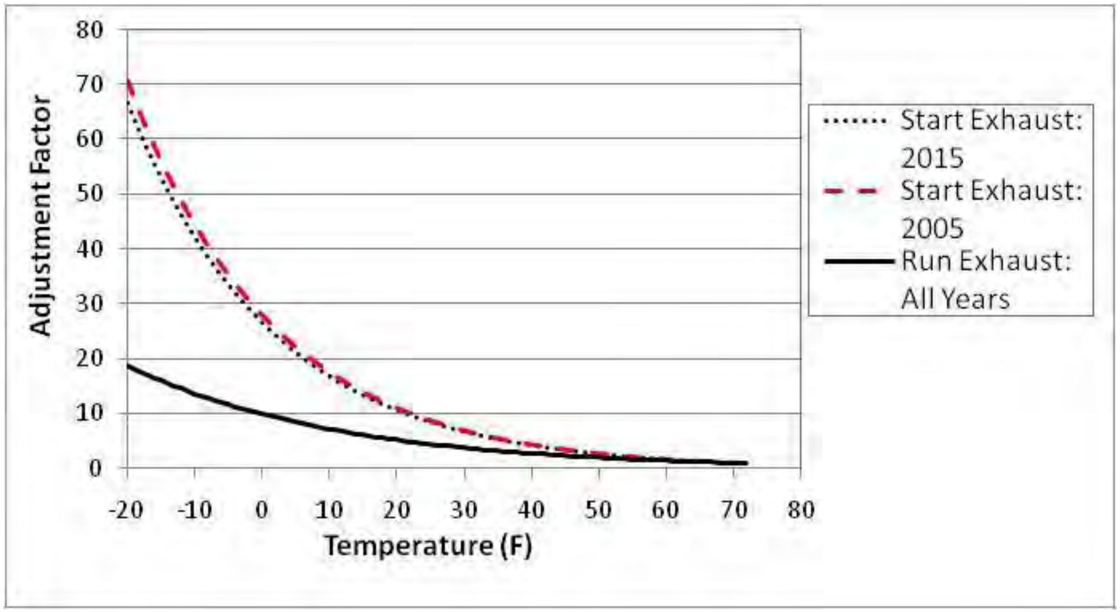
As discussed in the 2005v4.1 platform documentation, the MOVES2010 model was used for all vehicles, road types, and pollutants other than mercury, which came from 2005 NMIM. VMT were projected using growth rates from the Department of Energy's AEO2009. We used MOVES2010 to create emissions by state, SCC, pollutant, emissions mode and month. We then allocated these emissions to counties based on 2015 NMIM county-level data by state, SCC, pollutant, and emissions mode. 2016 NMIM data were not available for this effort, but the 2015 NMIM can reasonably be expected to be sufficient for this purpose. While EPA will eventually replace this approach with a county-specific implementation of MOVES, it was the best available approach for this modeling.

<u>MOVES-based cold start and running mode</u> (on_moves_startpm and on_moves_runpm)

MOVES-based cold start and running mode emissions consist of gasoline exhaust speciated PM and naphthalene. These pre-temperature-adjusted emissions are projected to year 2016 from year 2005 inventories using a 2016-specific run of MOVES2010. VMT were projected using growth rates from the AEO2009. As with the on_noadj sector, the 2016 MOVES2010 data were created at the state-month level, and the 2015 NMIM results were used to disaggregate the state level results to the county level.

As part of the SMOKE processing (described in the v4.1 platform documentation), we applied MOVES-based temperature adjustment factors to gridded, hourly emissions using gridded, hourly meteorology. Figure 3-2 illustrates the increase in PM emissions associated with decreasing temperatures for running exhaust and starting exhaust in 2005 and 2015. For the running mode in 2016, we used the same temperature adjustment factors as the 2005 base case. However, cold start temperature adjustment factors decrease slightly in future years, and for year 2016 processing, we updated the temperature adjustment curves for these cold start emissions to use the 2015 temperature adjustments which were the best available set of adjustments at the time the work was done. The change from 2005 to 2015 adjustment factors has little impact, reducing cold-start mode temperature-adjusted PM and naphthalene by under 4% for temperatures down to 0 °F. Therefore, we were comfortable using 2015 adjustment factors rather than 2016.

Figure 3-2. MOVES exhaust temperature adjustment functions for 2005and 2015



<u>Errors in 2016 PM emissions for on_no_adj, on_moves_startpm, and on_moves_runpm</u>

After completion of the modeling, two errors were discovered in the PM emissions from the onroad sector. The startpm and runpm sectors were impacted by the same error: they were doubly adjusted to account for cold temperatures. Instead of processing 72°F PM emissions through SMOKE and doing the temperature adjustment on the gridded hourly emissions, the PM emissions were already adjusted for state-average monthly temperatures and then additional adjustment factors were. The impact of this error was to over-estimate PM emissions particularly for the colder parts of the country which have the lowest temperatures and highest adjustment factors. The on_noadj PM was also found to be incorrect. The error occurred during SMOKE processing and resulting in dropping emissions of pre-speciated exhaust $PM_{2.5}$ from diesel vehicles due to incorrect SMOKE input speciation profiles. The impact of this error was to underestimate the $PM_{2.5}$. These errors impacted all states except California, which used other data as described above. Table 3-16 summarizes the impact of the $PM_{2.5}$ errors in the onroad sectors.

Table 3-16. Summary of the impact of $PM_{2.5}$ errors in the onroad sectors

State	**2016 $PM_{2.5}$ onroad corrected**	**2016 $PM_{2.5}$ onroad modeled**	**Error in onroad $PM_{2.5}$**	**Total state-level 2016 $PM_{2.5}$***	**All-sector $PM_{2.5}$ error****
Alabama	2,438	1,630	-33%	84,583	-1%
Arizona	3,755	1,821	-51%	76,788	-3%
Arkansas	1,399	1,113	-20%	61,689	0%
California	17,687	17,687	0%	253,741	0%
Colorado	2,692	4,383	63%	67,544	3%
Connecticut	1,465	2,995	104%	16,308	9%
Delaware	413	516	25%	5,801	2%
District of Columbia	185	229	24%	1,121	4%
Florida	7,540	4,177	-45%	210,183	-2%
Georgia	5,393	3,814	-29%	120,309	-1%
Idaho	895	1,559	74%	99,060	1%
Illinois	6,760	10,081	49%	115,808	3%
Indiana	3,988	5,599	40%	117,919	1%
Iowa	1,854	3,824	106%	71,682	3%

State	2016 $PM_{2.5}$ onroad corrected	2016 $PM_{2.5}$ onroad modeled	Error in onroad $PM_{2.5}$	Total state-level 2016 $PM_{2.5}$*	All-sector $PM_{2.5}$ error**
Kansas	1,391	1,741	25%	156,315	0%
Kentucky	2,422	2,349	-3%	63,917	0%
Louisiana	1,797	1,003	-44%	89,669	-1%
Maine	820	1,881	129%	22,114	5%
Maryland	2,646	3,594	36%	38,665	2%
Massachusetts	2,977	5,288	78%	43,343	5%
Michigan	6,352	10,976	73%	81,470	6%
Minnesota	3,466	10,935	215%	115,600	6%
Mississippi	1,780	879	-51%	63,451	-1%
Missouri	3,721	4,347	17%	99,315	1%
Montana	604	1,242	106%	54,412	1%
Nebraska	1,273	1,764	39%	56,593	1%
Nevada	565	735	30%	45,843	0%
New Hampshire	777	1,591	105%	16,578	5%
New Jersey	3,243	5,496	70%	28,049	8%
New Mexico	1,238	1,182	-5%	108,648	0%
New York	7,274	13,497	86%	83,242	7%
North Carolina	3,929	3,183	-19%	88,990	-1%
North Dakota	461	1,738	277%	51,940	2%
Ohio	5,813	8,444	45%	97,759	3%
Oklahoma	2,134	1,862	-13%	113,412	0%
Oregon	1,731	1,923	11%	135,881	0%
Pennsylvania	5,517	8,859	61%	90,961	4%
Rhode Island	361	760	110%	3,124	13%
South Carolina	2,227	1,553	-30%	55,421	-1%
South Dakota	506	1,131	123%	45,722	1%
Tennessee	3,896	3,043	-22%	69,254	-1%
Texas	11,683	6,116	-48%	304,737	-2%
Utah	1,418	2,334	65%	53,877	2%
Vermont	567	1,252	121%	9,018	8%
Virginia	3,759	4,327	15%	67,861	1%
Washington	3,346	3,675	10%	61,680	1%
West Virginia	843	1,088	29%	40,423	1%
Wisconsin	3,631	8,440	132%	63,379	8%
Wyoming	485	969	100%	66,505	1%
Total	**102,170**	**188,630**	**85%**	**3,891,291**	**2%**

*includes onroad, nonroad, ptnonipm, ptipm, afdust, avefire, alm_no_c3, seca_c3

**Negative means modeled emissions are an underestimate, positive means overestimate

3.3.2 Nonroad mobile (nonroad)

This sector includes monthly exhaust, evaporative and refueling emissions from nonroad engines (not including commercial marine, aircraft, and locomotives) derived from NMIM for all states except California. Like the onroad emissions, NMIM provides nonroad emissions for VOC by three emission modes: exhaust, evaporative and refueling. Unlike the onroad sector, nonroad refueling emissions for nonroad sources are not included in the nonpoint (nonpt) sector and so are retained in this sector.

With the exception of California, U.S. emissions for the nonroad sector (defined as the equipment types covered by NMIM) were created using a consistent NMIM-based approach as was used for 2005, but projected for 2016. Since we did not have readily available 2016 NMIM data, we used the output of a 2015 run of NMIM. The 2015 NMIM run utilized the NR05d-Bond-final version of NONROAD (which is equivalent to NONROAD2008a). We adjusted the 2015 NMIM data to 2016 by applying annual, national level SCC- and pollutant/mode-based[4] factors to the monthly 2015 NMIM data by SCC, pollutant, and emissions mode. These factors were generated from NONROAD2008a (v08a-out.mdb database) annual national level emissions. For nonroad mercury and NH_3, we used 2015 values for 2016 because there were no adjustment factors available for these pollutants in time for this effort.

These future-year emissions account for increases in activity (based on NONROAD model default growth estimates of future year equipment population) and changes in fuels and engines that reflect implementation of national regulations and local control programs that impact each year differently due to engine turnover.

The national regulations incorporated in the modeling are those promulgated prior to December 2009, and beginning about 1990. Recent rules include:

- "Clean Air Nonroad Diesel Final Rule - Tier 4", published June 29, 2004, and,
- Control of Emissions from Nonroad Large Spark-Ignition Engines, and Recreational Engines (Marine and Land-Based), November 8, 2002 ("Pentathalon Rule").
  OTAQ"s Locomotive Marine Rule.
- OTAQ"s Small Engine Spark Ignition ("Bond") Rule

We have not included voluntary programs such as programs encouraging either no refueling or evening refueling on Ozone Action Days and diesel retrofit programs. NMIM version 20071009, with county database NCD20070912, and NONROAD model version NONROAD2008a was used to create NMIM inventories for 2015.

California nonroad emissions

Similar to onroad mobile, NMIM was not used to generate future-year nonroad emissions for California, other than for NH_3. We used NMIM for California future nonroad NH_3 emissions because CARB did not provide these data for any nonroad vehicle types. As we did for onroad emissions, we chose a projection approach that would maintain consistency between the base year and future-year emissions for nonroad emissions in California.

California year 2016 nonroad CAP emissions were computed by linearly interpolating year 2014 and 2020 inventories. And 2016 HAP emissions were also computed using the same 2005-based CAP-HAP ratios used to create 2016 HAP emissions.

3.3.3 Locomotives and Class 1 & 2 commercial marine vessels (alm_no_c3)

Future locomotive and Class 1 and Class 2 commercial marine vessel (CMV) emissions were calculated using projection factors that were computed based on national, annual summaries of locomotive emissions in 2002 and future years. These national summaries were used to create national by-pollutant, by-SCC projection factors; these factors include final locomotive-marine controls and are provided in Table 3-17.

[4] VOC factors were provided for exhaust, evaporative and refueling modes.

Table 3-17. Factors applied to year 2005 emissions to project locomotives and Class 1 and Class 2 Commercial Marine Vessel Emissions

SCC	SCC Description	Pollutant	Year 2016 Factor
2280002X00	Marine Vessels, Commercial;Diesel;Underway & port emissions	CO	0.9431
2280002X00	Marine Vessels, Commercial;Diesel;Underway & port emissions	NH_3	1.1340
2280002X00	Marine Vessels, Commercial;Diesel;Underway & port emissions	NO_X	0.7334
2280002X00	Marine Vessels, Commercial;Diesel;Underway & port emissions	PM_{10}	0.6778
2280002X00	Marine Vessels, Commercial;Diesel;Underway & port emissions	$PM_{2.5}$	0.6896
2280002X00	Marine Vessels, Commercial;Diesel;Underway & port emissions	SO_2	0.1106
2280002X00	Marine Vessels, Commercial;Diesel;Underway & port emissions	VOC	0.8260
2285002006	Railroad Equipment;Diesel;Line Haul Locomotives: Class I Operations	CO	1.3128
2285002006	Railroad Equipment;Diesel;Line Haul Locomotives: Class I Operations	NH_3	1.3040
2285002006	Railroad Equipment;Diesel;Line Haul Locomotives: Class I Operations	NO_X	0.6577
2285002006	Railroad Equipment;Diesel;Line Haul Locomotives: Class I Operations	PM_{10}	0.6205
2285002006	Railroad Equipment;Diesel;Line Haul Locomotives: Class I Operations	$PM_{2.5}$	0.6287
2285002006	Railroad Equipment;Diesel;Line Haul Locomotives: Class I Operations	SO_2	0.0051
2285002006	Railroad Equipment;Diesel;Line Haul Locomotives: Class I Operations	VOC	0.6473
2285002007	Railroad Equipment;Diesel;Line Haul Locomotives: Class II / III Operations	CO	0.3226
2285002007	Railroad Equipment;Diesel;Line Haul Locomotives: Class II / III Operations	NH_3	1.3040
2285002007	Railroad Equipment;Diesel;Line Haul Locomotives: Class II / III Operations	NO_X	0.3512
2285002007	Railroad Equipment;Diesel;Line Haul Locomotives: Class II / III Operations	PM_{10}	0.2857
2285002007	Railroad Equipment;Diesel;Line Haul Locomotives: Class II / III Operations	$PM_{2.5}$	0.2882
2285002007	Railroad Equipment;Diesel;Line Haul Locomotives: Class II / III Operations	SO_2	0.0012
2285002007	Railroad Equipment;Diesel;Line Haul Locomotives: Class II / III Operations	VOC	0.3098
2285002008	Railroad Equipment;Diesel;Line Haul Locomotives: Passenger Trains (Amtrak)	CO	1.0629
2285002008	Railroad Equipment;Diesel;Line Haul Locomotives: Passenger Trains (Amtrak)	NH_3	1.3040
2285002008	Railroad Equipment;Diesel;Line Haul Locomotives: Passenger Trains (Amtrak)	NO_X	0.5251
2285002008	Railroad Equipment;Diesel;Line Haul Locomotives: Passenger Trains (Amtrak)	PM_{10}	0.5006
2285002008	Railroad Equipment;Diesel;Line Haul Locomotives: Passenger Trains (Amtrak)	$PM_{2.5}$	0.5028
2285002008	Railroad Equipment;Diesel;Line Haul Locomotives: Passenger Trains (Amtrak)	SO_2	0.0047
2285002008	Railroad Equipment;Diesel;Line Haul Locomotives: Passenger Trains (Amtrak)	VOC	0.5304
2285002009	Railroad Equipment;Diesel;Line Haul Locomotives: Commuter Lines	CO	1.0483
2285002009	Railroad Equipment;Diesel;Line Haul Locomotives: Commuter Lines	NH_3	1.3040
2285002009	Railroad Equipment;Diesel;Line Haul Locomotives: Commuter Lines	NO_X	0.5179
2285002009	Railroad Equipment;Diesel;Line Haul Locomotives: Commuter Lines	PM_{10}	0.4937
2285002009	Railroad Equipment;Diesel;Line Haul Locomotives: Commuter Lines	$PM_{2.5}$	0.4937
2285002009	Railroad Equipment;Diesel;Line Haul Locomotives: Commuter Lines	SO_2	0.0047
2285002009	Railroad Equipment;Diesel;Line Haul Locomotives: Commuter Lines	VOC	0.5231
2285002010	Railroad Equipment;Diesel;Yard Locomotives	CO	1.3203
2285002010	Railroad Equipment;Diesel;Yard Locomotives	NH_3	1.3040
2285002010	Railroad Equipment;Diesel;Yard Locomotives	NO_X	1.1194
2285002010	Railroad Equipment;Diesel;Yard Locomotives	PM_{10}	0.9072
2285002010	Railroad Equipment;Diesel;Yard Locomotives	$PM_{2.5}$	0.9262
2285002010	Railroad Equipment;Diesel;Yard Locomotives	SO_2	0.0056
2285002010	Railroad Equipment;Diesel;Yard Locomotives	VOC	1.4964

The future-year locomotive emissions account for increased fuel consumption based on Energy Information Administration (EIA) fuel consumption projections for freight rail, and emissions reductions resulting from emissions standards from the Final Locomotive-Marine rule (EPA, 2007c). This rule lowered diesel sulfur content and tightened emission standards for existing and new locomotives and marine diesel emissions to lower future year PM, SO_2, and NO_X. Voluntary retrofits under the National Clean Diesel Campaign are not included in our projections.

We applied HAP factors for VOC HAPs by using the VOC projection factors to obtain 1,3-butadiene, acetaldehyde, acrolein, benzene, and formaldehyde. Mercury, not already provided, was held at base-year levels for 2016 (i.e., we used the 2002 emissions estimates used in the 2005 base case).

Class 1 and 2 CMV gasoline emissions (SCC = 2280004000) were not changed for future year processing. C1/C2 diesel emissions (SCC = 2280002100 and 2280002200) were projected based on the Final Locomotive Marine rule national-level factors provided in Table 3-17. Similar to locomotives, VOC HAPs were projected based on the VOC factor and mercury was held at levels in the 2005 (2002 inventory) base case.

3.3.4 Class 3 commercial marine vessels (seca_c3)

The seca_c3 sector emissions data were provided by OTAQ in an ASCII raster format used since the SO_2 Emissions Control Area-International Marine Organization (ECA-IMO) project began in 2005. The (S)ECA Category 3 (C3) commercial marine vessel 2002 base case emissions were projected to year 2005 for the 2005 base case and to year 2016 for the future base case. This future base case includes ECA-IMO controls. An overview of the ECA-IMO project and future year goals for reduction of NO_X, SO_2, and PM C3 emissions can be found at: Vehicles and Engines.

The resulting coordinated strategy, including emission standards under the Clean Air Act for new marine diesel engines with per-cylinder displacement at or above 30 liters, and the establishment of Emission Control Areas is at.

These projection factors vary depending on geographic region and pollutant; where VOC HAPs and all criteria air pollutants except for NO_X are assigned region-specific growth rates and NO_X receives different rates.

The projection factors used to create the 2016 base case seca_c3 sector emissions are provided in Table 3-18. Note that these factors are relative to 2002. Factors relative to 2005 can be computed from the 2002-2005 factors.

The geographic regions are described in the ECA proposal technical support document: Vehicles and Engines. These regions extend up to 200 nautical miles offshore, though less at international boundaries. North and South Pacific regions are divided by the Oregon-Washington border, and East Coast and Gulf Coast regions are divided east-west by roughly the upper Florida Keys just southwest of Miami.

The factors to compute HAP emission are based on emissions ratios discussed in the 2005v4 documentation. As with the 2005 base case, this sector uses CAP-HAP VOC integration. Mercury, although present in the 2005v4 inventory was not used for either the 2005 base case in the 2005v4.1 platform or the 2016 case. The 2005v4 platform Hg emissions total for the sector, including U.S. and non-U.S. sources, is less than 0.001 tons/yr.

Table 3-18. Factors to Project Class 3 Commercial Marine Vessel emissions to 2016

Adjustments Relative to 2002						
	NOx	**PM10**	**PM2.5**	**VOC/HC**	**CO**	**SO2**
Alaska East (AE)	1.39411	0.19817	0.19630	1.57863	1.57803	0.06025
Alaska West (AW)	1.42713	1.52045	1.52076	1.52054	1.52057	1.52050
East Coast (EC)	1.46173	0.25428	0.25255	1.87044	1.87014	0.06677
Gulf Coast (GC)	1.15962	0.20333	0.20120	1.48548	1.48642	0.05321
Hawaii East (HE)	1.54794	0.25771	0.25518	1.93871	1.94003	0.07430
Hawaii West (HW)	1.66069	1.93956	1.93762	1.94025	1.93952	1.94001
North Pacific (NP)	1.26904	0.21948	0.21521	1.59156	1.59099	0.06167
South Pacific (SP)	1.59215	0.28052	0.27800	2.00973	2.00573	0.07933
Great Lakes (GL)	1.10725	0.16932	0.16770	1.28006	1.27933	0.04518
Outside ECA	1.53081	1.80933	1.80933	1.80933	1.80933	1.80933

3.3.5 Future Year VOC Speciation (on_noadj, nonroad)

We used speciation profiles for VOC in the nonroad and on_noadj sectors that account for the increase in ethanol content of fuels in future years. The combination profiles use proportions of E0 and E10 expected in the future based on AEO 2007 projections of E10 and E0 fuel use. The proportions of E0 and E10 are the same for 2012 and years beyond (even though the quantities of the two fuels change over these years). The national proportions were allocated to counties across the country using the same fuel modeling done for the stationary source gasoline speciation, as discussed in Section 3.2.8.

The speciation of onroad exhaust VOC additionally accounts for a portion of the vehicle fleet meeting Tier 2 standards; different exhaust profiles are available for pre-Tier 2 versus Tier 2 vehicles. Thus for exhaust VOC, a combination of pre-Tier 2 E0, pre-Tier 2 E10, Tier 2 E0 and Tier 2 E10 profiles are used. Figure 3-3 shows the Tier 2 fraction of Light Duty Vehicles for different future years in terms of different metrics. For previous modeling applications, we based the fraction on the population of vehicles. However, since these vehicles emit a smaller portion of VOC, a more appropriate metric for use in weighting the speciation profiles is the fraction of exhaust total hydrocarbons (THC) which is used in the 2016 case described here. The fraction of Tier 2 emissions used here for 2016 is 0.358.

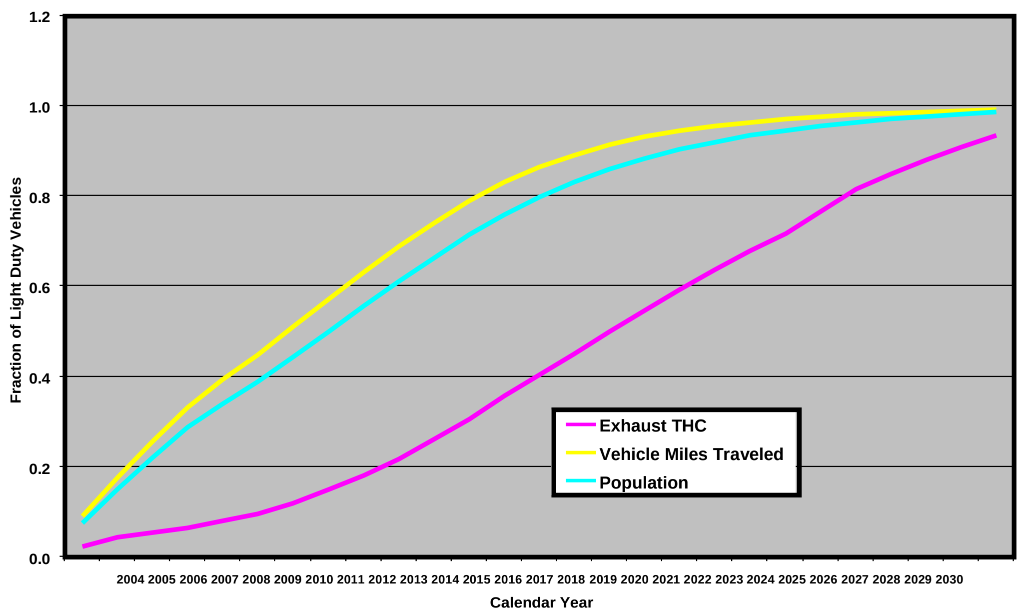
Table 3-19 summarizes the profiles combined for the source categories and VOC emission modes used.

Table 3-19. Future Year Profiles for Mobile Source Related Sources

Sector	Type of profile	Profile Codes Combined for the Future Year Speciation
Stationary	headspace	**8762**: Composite Profile - Gasoline Headspace Vapor using 0% Ethanol **8763**: Composite Profile - Gasoline Headspace Vapor using 10% Ethanol
Nonroad exhaust	Pre-Tier 2 vehicle exhaust	**8750**: Gasoline Exhaust - Reformulated gasoline **8751**: Gasoline Exhaust - E10 ethanol gasoline
Onroad and Nonroad evap*	Evaporative	**8753**: Gasoline Vehicle - Evaporative emission - Reformulated gasoline **8754**: Gasoline Vehicle - Evaporative emission - E10 ethanol gasoline
Nonroad refueling	headspace	Same as Stationary
Onroad exhaust	Pre-Tier 2 vehicle exhaust and Tier 2 vehicle exhaust	**8750**: Gasoline Exhaust - Reformulated gasoline **8751**: Gasoline Exhaust - E10 ethanol gasoline **8756**: Composite Profile - Gasoline Exhaust - Tier 2 light-duty vehicles using 0% Ethanol **8757**: Composite Profile - Gasoline Exhaust - Tier 2 light-duty vehicles using 10% Ethanol

- E0 and E10 combinations are based on AEO2007 projections of E0 and E10 fuel
- Tier 2 and pre-Tier 2 combinations are based on the 2016 contribution of Tier 2 exhaust emissions

Figure 3-3. Tier 2 Fraction of Light Duty Vehicles



3.4 *Canada, Mexico, and Offshore sources (othar, othon, othpt, othar_hg, and othpt_hg)*

Emissions for Canada, Mexico, and offshore sources were not projected to future years, and are therefore the same as those used in the 2005 base case. Therefore, the Mexico emissions are based on year 1999, offshore oil is based on year 2005, and Canada is based on year 2006. For both Mexico and Canada, their responsible agencies could not provide future year emissions that were consistent with the base year emissions.

4 EGU Control Case for 2016

The Toxics Rule Control Case (also known as “policy case”) is intended to represent the implementation of acid gas, mercury and associated criteria pollutant reductions associated with the Toxics Rule. However, due to timing constraints for the Toxics Rule Proposal, the actual control case used in the air quality modeling did not allow for the final version of IPM policy case to be used. More information on the IPM used can be found in the technical support document for the IPM modeling done for the Toxics Rule. A comparison between the IPM emissions used in the air quality model and the emissions from the “final” IPM cases for select pollutants is presented in the Regulatory Impacts Assessment for the Proposed Toxics Rule.

As with the base case, we applied the Boiler MACT reductions associated with units in the ptipm sector, and we removed the Hg associated with Boiler MACT sources. This resulted in the removal of 0.128 tons/year of Hg was removed from the control case data provided by CAMD, which prevented double counting Hg emissions from boilers accounted for in the ptnonipm sector. The impacts on the non-Hg pollutants of the Boiler MACT controls are provided in Table 4-1.

Table 4-1. Boiler MACT reductions applied to policy case ptipm sector emissions prior to AQ modeling

	Tons reduced due to Boiler MACT
HCL	675
CO	845
PM_{10}	698
$PM_{2.5}$	606
SO_2	18,747
VOC	19

5 Emission Summaries for the Base Cases and Control Case

The following tables summarize emissions differences between the 2005 base case, 2016 base case and the 2016 policy case.

Table 5-1 provides 48-state summed emissions by sector in 2016 and 2005for criteria pollutants, and Table 5-2 provides the same information for mercury, HCL, and CL2. The speciated mercury emissions by state and sector in the 2005 and 2016 base cases are provided in Table 5-3.

For the 2016 policy case, only the ptipm sector is different from the 2016 base case. State emissions of NO_X, SO_2 and VOC for the ptipm sector for 2005, 2016 base, and the 2016 policy case are provided in Table 5-4. The same information for mercury and HCL is provided in Table 5-5, and Table 5-6 provides speciated mercury by state for the 2005 and 2016 base cases.

Table 5-7 provides sector-specific SO_2 emissions (except for biogenic emissions) by state for the 2016 base case, and Table 5-8 provides the same resolution of information as Table 5-7, but for $PM_{2.5}$.

Table 5-1. 2016 Emissions – 2016 Base Case Compared to 2005 Base Case: VOC, NO_X, CO, SO_2, NH_3, and PM

	[tons/yr]	[tons/yr]	[tons/yr]	[tons/yr]	[tons/yr]	[tons/yr]	[tons/yr]	[tons/yr]	[tons/yr]	[tons/yr]	[tons/yr]	[tons/yr]	[tons/yr]	[tons/yr]
Sector	**2016 VOC**	**2005 VOC**	**2016 NOx**	**2005 NOx**	**2016 CO**	**2005 CO**	**2016 SO2**	**2005 SO2**	**2016 NH3**	**2005 NH3**	**2016 PM_{10}**	**2005 PM_{10}**	**2016 PM_{2_5}**	**2005 PM_{2_5}**
afdust											8,8613,385	8,858,992	1,030,631	1,030,391
ag									3,446,632	3,251,990				
alm_no_c3	49,665	67,690	1,353,680	1,924,925	296,121	270,007	9,087	154,016	940	773	38,789	59,366	37,604	56,687
seca_c3	69,080	44,990	815,249	647,884	82,929	54,049	23,659	420,110			11,324	53,918	10,324	49,541
seca_c3 non-US	126,898	18,367	1,603,944	532,181	149,443	43,267	957,065	321,414			131,137	43,326	120,617	39,810
nonpt	7,322,980	7,530,564	1,668,679	1,699,532	6,973,593	7,413,762	1,250,300	1,259,635	133,428	134,080	1,302,733	1,354,638	1,029,916	1,081,816
nonroad	1,577,015	2,691,844	1,271,892	2,115,408	13,431,076	19,502,718	2,870	197,341	2,345	1,972	129,217	211,807	121,215	201,138
on_noadj	2,064,152	3,949,362	4,285,847	9,142,274	25,930,932	43,356,130	26,784	177,977	82,013	156,528	114,073	308,497	40,587	236,927
on_moves_runpm											88,929	54,071	81,887	49,789
on_moves_startpm											71,509	22,729	65,846	20,929
ptipm	40,845	40,950	1,769,764	3,726,459	691,310	601,564	3,577,698	10,380,786	36,655	21,684	523,504	615,095	384,320	508,903
ptnonipm	1,180,794	1,310,784	2,061,353	2,238,002	3,038,429	3,221,388	1,349,038	2,089,836	158,242	158,837	597,324	653,048	404,926	440,714
avefire	1,958,992	1,958,992	189,428	189,428	8,554,551	8,554,551	49,094	49,094	36,777	36,777	796,229	796,229	684,035	684,035
2016cr2 non-fires Total	12,431,429	15,654,551	14,830,408	22,026,665	50,593,833	74,462,885	7,196,501	15,001,115	3,860,256	3,725,864	11,869,924	12,235,487	3,327,874	3,716,645

Table 5-2. 2016 Emissions – Base Case Compared to 2005 Base Case: mercury (species and total), HCL and CL2

Sector	[tons/yr] 2016 HGIIGAS	[tons/yr] 2005 HGIIGAS	[tons/yr] 2016 HGNRVA	[tons/yr] 2005 HGNRVA	[tons/yr] 2016 PHGI	[tons/yr] 2005 PHGI	[tons/yr] 2016 Total Hg (sum of 3 species)	[tons/yr] 2005 Total Hg (sum of 3 species)	[tons/yr] 2016 HCL	[tons/yr] 2005 HCL	[tons/yr] 2016 CL2	[tons/yr] 2005 CL2
afdust												
ag												
alm_no_c3	0.0411	0.0411	0.0793	0.0793	0.0212	0.0212	0.1416	0.1416			1.38	1.38
seca_c3	*	*	*	*	*	*	*	*				
seca_c3 non-US	*	*	*	*	*	*	*	*				
nonpt	1.0605	1.0605	3.1034	3.1034	0.6524	0.6524	4.8163	4.8163	29,001	29,001	2,108	2,135
nonroad	0.1041	0.1041	0.2105	0.2105	0.0533	0.0533	0.3679	0.3679				
on_noadj	0.1402	0.1402	0.5036	0.5036	0.0599	0.0599	0.7037	0.7037				
on_moves_runpm												
on_moves_startpm												
ptipm	6.8757	21.0960	21.1598	30.1986	0.6683	1.6136	28.7038	52.9082	74,089	351,592		99
ptnonipm	7.9112	10.4687	16.8535	29.5686	4.4183	6.1291	29.183	46.1664	37,549	48,630	3,941	4,174
avefire												
2016cr2 non-fires Total	16.13	32.91	41.91	63.66	5.87	8.53	64	105	140,639	429,223	6,050	6,409

*due to uncertainty in mercury emissions from this sector, they were removed from the inventories and not used. The amount removed from the 2005 data was on the order of 0.001 tons total mercury for the sum of U.S. and non-U.S. components

Table 5-3. Speciated Mercury and total Mercury by State and Sector for 2005 and 2016

		ptipm		ptnonipm		nonpt		onroad	alm	nonroad	all US sectors	
		[tons/yr]		[tons/yr]		[tons/yr]		[tons/yr]	[tons/yr]	[tons/yr]	[tons/yr]	
State	Species of	2005	2016	2005	2016	2005	2016	2005= 2016	2005= 2016	2005= 2016	2005	2016
Alabama	HGIIGAS	1.160	0.288	0.233	0.140	4.9E-04	4.9E-04	5.9E-04		3.2E-05	1.394	0.429
Alabama	HGNRVA	1.419	0.948	1.105	0.453	0.029	0.029	6.2E-03		2.4E-04	2.56	1.44
Alabama	PHGI	0.084	0.019	0.161	0.094	2.4E-04	2.4E-04	3.2E-05		6.6E-06	0.245	0.113
Alabama	Total HG	2.663	1.255	1.499	0.687	0.029	0.029	6.8E-03		2.8E-04	4.20	1.98
Arizona	HGIIGAS	0.052	0.133	0.035	0.017	2.4E-03	2.4E-03	6.1E-04		3.9E-05	0.089	0.153
Arizona	HGNRVA	0.657	0.609	0.145	0.044	0.027	0.027	6.4E-03		2.6E-04	0.836	0.686
Arizona	PHGI	0.007	0.007	0.028	0.012	8.3E-04	8.3E-04	3.5E-05		9.4E-06	0.036	0.020
Arizona	Total HG	0.716	0.749	0.208	0.074	0.030	0.030	7.0E-03		3.1E-04	0.961	0.860
Arkansas	HGIIGAS	0.144	0.198	0.221	0.164	4.6E-04	4.6E-04	3.3E-04		2.4E-05	0.365	0.363
Arkansas	HGNRVA	0.364	0.525	0.364	0.303	0.016	0.016	3.5E-03		1.6E-04	0.748	0.848
Arkansas	PHGI	9.3E-04	1.1E-03	0.110	0.085	1.8E-04	1.8E-04	1.8E-05		6.4E-06	0.111	0.087
Arkansas	Total HG	0.509	0.725	0.694	0.552	0.017	0.017	3.8E-03		1.9E-04	1.224	1.298
California	HGIIGAS	0.001	0.042	0.757	0.599	0.462	0.462	0.113	0.037	1.0E-01	1.472	1.355
California	HGNRVA	0.003	0.052	2.118	1.068	0.728	0.728	0.218	0.071	2.0E-01	3.336	2.335
California	PHGI	0.001	0.039	0.514	0.360	0.298	0.298	0.058	0.019	5.3E-02	0.943	0.827
California	Total HG	0.005	0.132	3.389	2.027	1.488	1.488	0.390	0.127	3.5E-01	5.751	4.517
Colorado	HGIIGAS	0.103	0.026	0.167	0.154	2.5E-04	2.5E-04	5.0E-04		3.4E-05	0.271	0.181
Colorado	HGNRVA	0.321	0.055	0.458	0.372	6.4E-03	6.4E-03	5.3E-03		2.3E-04	0.791	0.438
Colorado	PHGI	0.005	0.003	0.120	0.108	1.7E-04	1.7E-04	2.5E-05		8.4E-06	0.125	0.111
Colorado	Total HG	0.429	0.083	0.746	0.634	6.8E-03	6.8E-03	5.8E-03		2.7E-04	1.187	0.730
Connecticut	HGIIGAS	0.040	0.004	0.099	0.099	0.037	0.037	3.4E-04		2.0E-05	0.176	0.140
Connecticut	HGNRVA	0.077	0.003	0.049	0.049	0.081	0.081	3.6E-03		1.6E-04	0.211	0.136
Connecticut	PHGI	0.004	0.000	0.036	0.036	0.024	0.024	1.6E-05		3.5E-06	0.064	0.061
Connecticut	Total HG	0.121	0.007	0.184	0.184	0.142	0.142	3.9E-03		1.8E-04	0.451	0.337
Delaware	HGIIGAS	0.109	0.006	0.029	0.008	2.5E-05	2.5E-05	9.8E-05	5.3E-04	5.7E-06	0.139	0.015
Delaware	HGNRVA	0.055	0.003	0.173	0.022	6.8E-05	6.8E-05	1.0E-03	1.0E-03	4.4E-05	0.230	0.027
Delaware	PHGI	0.016	0.000	0.016	0.006	1.8E-05	1.8E-05	5.1E-06	2.7E-04	1.2E-06	0.032	0.006
Delaware	Total HG	0.180	0.009	0.219	0.035	1.1E-04	1.1E-04	1.1E-03	1.8E-03	5.1E-05	0.402	0.047
District of Columbia	HGIIGAS	0.001		0.000	0.000	6.1E-04	6.1E-04	4.2E-05		2.3E-06	0.002	0.001
District of Columbia	HGNRVA	0.001		0.000	0.000	3.0E-03	3.0E-03	4.5E-04		1.1E-05	0.005	0.004
District of Columbia	PHGI	0.001		0.000	0.000	4.1E-04	4.1E-04	2.1E-06		7.9E-07	0.001	0.001
District of Columbia	Total HG	0.003		0.001	0.001	4.0E-03	4.0E-03	4.9E-04		1.4E-05	0.008	0.005
Florida	HGIIGAS	0.544	0.145	0.350	0.284	9.0E-03	9.0E-03	2.1E-03		1.4E-04	0.904	0.441
Florida	HGNRVA	0.550	0.260	0.639	0.222	0.081	0.081	0.022		1.1E-03	1.293	0.585
Florida	PHGI	0.079	0.081	0.182	0.115	3.2E-03	3.2E-03	1.1E-04		3.0E-05	0.265	0.199
Florida	Total HG	1.173	0.486	1.170	0.621	0.093	0.093	0.024		1.2E-03	2.46	1.225
Georgia	HGIIGAS	0.964	0.241	0.097	0.052	1.7E-03	1.7E-03	1.1E-03		5.7E-05	1.064	0.296
Georgia	HGNRVA	0.666	0.262	0.542	0.122	0.063	0.063	0.012		4.0E-04	1.282	0.459

		ptipm		ptnonipm		nonpt		onroad	alm	nonroad	all US sectors	
		[tons/yr]		[tons/yr]		[tons/yr]		[tons/yr]	[tons/yr]	[tons/yr]	[tons/yr]	
State	Species of	2005	2016	2005	2016	2005	2016	2005= 2016	2005= 2016	2005= 2016	2005	2016
Georgia	PHGI	0.074	0.009	0.051	0.031	8.0E-04	8.0E-04	6.3E-05		1.3E-05	0.126	0.041
Georgia	Total HG	1.704	0.512	0.690	0.206	0.065	0.065	0.013		4.7E-04	2.47	0.796
Idaho	HGIIGAS			0.115	0.113			1.3E-04		1.6E-05	0.115	0.113
Idaho	HGNRVA			0.195	0.188			1.4E-03		1.1E-04	0.196	0.190
Idaho	PHGI			0.077	0.075			7.0E-06		3.8E-06	0.077	0.075
Idaho	Total HG			0.386	0.376			1.6E-03		1.3E-04	0.388	0.378
Illinois	HGIIGAS	1.367	0.124	0.382	0.338	0.012	0.012	1.1E-03		9.1E-05	1.763	0.475
Illinois	HGNRVA	2.819	0.361	1.227	1.007	0.087	0.087	0.012		5.6E-04	4.145	1.468
Illinois	PHGI	0.056	0.003	0.245	0.207	8.3E-03	8.3E-03	0.000		2.6E-05	0.309	0.219
Illinois	Total HG	4.242	0.488	1.853	1.553	0.108	0.108	0.013		6.8E-04	6.217	2.162
Indiana	HGIIGAS	1.141	0.417	0.726	0.548	4.6E-03	4.6E-03	7.4E-04		5.0E-05	1.872	0.970
Indiana	HGNRVA	1.670	1.130	1.410	1.146	0.045	0.045	7.7E-03		3.1E-04	3.134	2.330
Indiana	PHGI	0.068	0.011	0.394	0.308	2.8E-03	2.8E-03	4.0E-05		1.4E-05	0.465	0.321
Indiana	Total HG	2.879	1.558	2.530	2.002	0.053	0.053	8.5E-03		3.8E-04	5.471	3.622
Iowa	HGIIGAS	0.279	0.193	0.159	0.088	2.2E-03	2.2E-03	3.3E-04		4.6E-05	0.440	0.284
Iowa	HGNRVA	0.876	0.802	0.431	0.210	0.022	0.022	3.4E-03		2.6E-04	1.332	1.038
Iowa	PHGI	0.003	0.004	0.115	0.062	1.3E-03	1.3E-03	1.7E-05		1.4E-05	0.120	0.067
Iowa	Total HG	1.158	0.999	0.705	0.360	0.026	0.026	3.8E-03		3.2E-04	1.893	1.389
Kansas	HGIIGAS	0.167	0.114	0.259	0.176	6.1E-04	6.1E-04	3.0E-04		3.0E-05	0.427	0.291
Kansas	HGNRVA	0.834	0.837	0.189	0.120	0.019	0.019	3.2E-03		1.4E-04	1.045	0.980
Kansas	PHGI	0.007	0.004	0.101	0.068	2.4E-04	2.4E-04	1.6E-05		1.1E-05	0.108	0.072
Kansas	Total HG	1.008	0.955	0.548	0.364	0.020	0.020	3.5E-03		1.8E-04	1.580	1.343
Kentucky	HGIIGAS	0.799	0.131	0.133	0.100	2.7E-03	2.7E-03	5.0E-04		2.7E-05	0.935	0.234
Kentucky	HGNRVA	0.897	0.682	0.471	0.303	0.024	0.024	5.2E-03		1.8E-04	1.398	1.015
Kentucky	PHGI	0.062	0.015	0.090	0.063	1.7E-03	1.7E-03	2.8E-05		7.0E-06	0.155	0.079
Kentucky	Total HG	1.759	0.828	0.694	0.466	0.029	0.029	5.8E-03		2.2E-04	2.49	1.33
Louisiana	HGIIGAS	0.148	0.244	0.171	0.104	4.8E-04	4.8E-04	4.6E-04		3.3E-05	0.320	0.349
Louisiana	HGNRVA	0.459	0.676	1.145	0.183	0.021	0.021	4.8E-03		2.5E-04	1.630	0.886
Louisiana	PHGI	0.002	0.099	0.073	0.064	1.9E-04	1.9E-04	2.5E-05		6.8E-06	0.075	0.163
Louisiana	Total HG	0.609	1.019	1.388	0.352	0.022	0.022	5.3E-03		2.9E-04	2.025	1.398
Maine	HGIIGAS	0.001	0.009	0.040	0.032	0.029	0.029	1.5E-04		1.5E-05	0.071	0.070
Maine	HGNRVA	0.002	0.003	0.064	0.039	0.076	0.076	1.6E-03		1.3E-04	0.143	0.120
Maine	PHGI	8.9E-04	7.9E-04	0.023	0.018	0.017	0.017	8.3E-06		2.0E-06	0.041	0.036
Maine	Total HG	0.004	0.013	0.127	0.089	0.122	0.122	1.8E-03		1.5E-04	0.255	0.226
Maryland	HGIIGAS	0.535	0.031	0.242	0.198	0.032	0.032	5.9E-04		3.3E-05	0.809	0.262
Maryland	HGNRVA	0.301	0.077	0.328	0.152	0.076	0.076	6.2E-03		2.5E-04	0.712	0.311
Maryland	PHGI	0.053	0.006	0.111	0.076	0.021	0.021	3.0E-05		6.4E-06	0.185	0.103
Maryland	Total HG	0.890	0.114	0.681	0.426	0.129	0.129	6.8E-03		2.9E-04	1.707	0.677
Massachusetts	HGIIGAS	0.111	0.003	0.091	0.090	0.068	0.068	6.0E-04		3.3E-05	0.270	0.162
Massachusetts	HGNRVA	0.055	0.006	0.111	0.110	0.204	0.204	6.3E-03		2.6E-04	0.377	0.326
Massachusetts	PHGI	0.016	0.000	0.035	0.034	0.041	0.041	3.0E-05		6.1E-06	0.092	0.076

		ptipm		ptnonipm		nonpt		onroad	alm	nonroad	all US sectors	
		[tons/yr]		[tons/yr]		[tons/yr]		[tons/yr]	[tons/yr]	[tons/yr]	[tons/yr]	
State	Species of	2005	2016	2005	2016	2005	2016	2005= 2016	2005= 2016	2005= 2016	2005	2016
Massachusetts	Total HG	0.182	0.009	0.237	0.234	0.313	0.313	7.0E-03		3.0E-04	0.739	0.564
Michigan	HGIIGAS	0.968	0.340	0.216	0.145	0.011	0.011	1.1E-03		9.4E-05	1.197	0.498
Michigan	HGNRVA	0.781	1.155	0.716	0.400	0.070	0.070	1.1E-02		7.6E-04	1.579	1.637
Michigan	PHGI	0.077	5.8E-03	0.153	0.094	0.007	0.007	5.7E-05		1.7E-05	0.237	0.107
Michigan	Total HG	1.826	1.501	1.086	0.639	0.088	0.088	0.012		8.7E-04	3.013	2.242
Minnesota	HGIIGAS	0.096	0.036	0.814	0.791	9.2E-03	9.2E-03	5.7E-04		6.5E-05	0.920	0.836
Minnesota	HGNRVA	0.603	0.124	0.826	0.760	0.029	0.029	6.0E-03		4.5E-04	1.464	0.919
Minnesota	PHGI	0.009	0.001	0.336	0.319	5.3E-03	5.3E-03	3.0E-05		1.6E-05	0.350	0.326
Minnesota	Total HG	0.707	0.161	1.977	1.869	0.043	0.043	6.6E-03		5.3E-04	2.734	2.080
Mississippi	HGIIGAS	0.126	0.140	0.088	0.069	2.7E-04	2.7E-04	4.2E-04		2.1E-05	0.215	0.209
Mississippi	HGNRVA	0.156	0.264	0.190	0.156	0.015	0.015	4.4E-03		1.5E-04	0.365	0.439
Mississippi	PHGI	0.010	0.001	0.052	0.042	1.2E-04	1.2E-04	2.4E-05		5.0E-06	0.063	0.043
Mississippi	Total HG	0.292	0.405	0.330	0.267	0.015	0.015	4.8E-03		1.8E-04	0.643	0.692
Missouri	HGIIGAS	0.702	0.472	0.452	0.277	1.2E-03	1.2E-03	7.2E-04		4.6E-05	1.156	0.752
Missouri	HGNRVA	1.129	1.471	0.560	0.414	2.0E-03	2.0E-03	7.5E-03		3.0E-04	1.698	1.895
Missouri	PHGI	0.024	0.005	0.199	0.128	8.1E-04	8.1E-04	3.9E-05		1.2E-05	0.224	0.134
Missouri	Total HG	1.854	1.949	1.211	0.819	4.1E-03	4.1E-03	8.3E-03		3.6E-04	3.078	2.780
Montana	HGIIGAS	0.030	0.010	0.024	0.020	1.0E-03	1.0E-03	1.1E-04		1.3E-05	0.055	0.032
Montana	HGNRVA	0.468	0.076	0.053	0.037	6.3E-03	6.3E-03	1.2E-03		6.7E-05	0.528	0.121
Montana	PHGI	0.007	0.011	0.017	0.014	5.4E-04	5.4E-04	6.5E-06		4.6E-06	0.025	0.025
Montana	Total HG	0.504	0.097	0.095	0.071	7.9E-03	7.9E-03	1.3E-03		8.5E-05	0.608	0.177
Nebraska	HGIIGAS	0.118	0.168	0.028	0.021	6.0E-04	6.0E-04	2.0E-04		2.5E-05	0.146	0.190
Nebraska	HGNRVA	0.224	0.252	0.108	0.073	9.9E-03	9.9E-03	2.1E-03		1.1E-04	0.345	0.337
Nebraska	PHGI	0.002	0.002	0.021	0.015	3.0E-04	3.0E-04	1.2E-05		9.4E-06	0.023	0.018
Nebraska	Total HG	0.344	0.423	0.157	0.109	0.011	0.011	2.3E-03		1.4E-04	0.514	0.545
Nevada	HGIIGAS	0.091	0.011	0.021	0.019	0.001	0.001	2.0E-04		1.8E-05	0.114	0.032
Nevada	HGNRVA	0.217	0.075	2.554	0.751	0.011	0.011	2.2E-03		1.2E-04	2.784	0.839
Nevada	PHGI	0.002	0.002	0.019	0.017	0.001	0.001	9.6E-06		4.9E-06	0.022	0.020
Nevada	Total HG	0.310	0.087	2.594	0.788	0.013	0.013	2.4E-03		1.4E-04	2.919	0.891
New Hampshire	HGIIGAS	0.015	0.001	0.015	0.010	0.013	0.013	1.4E-04	2.9E-05	1.1E-05	0.043	0.025
New Hampshire	HGNRVA	0.012	0.009	0.019	0.011	0.028	0.028	1.5E-03	5.6E-05	9.7E-05	0.060	0.050
New Hampshire	PHGI	3.9E-03	3.2E-04	8.5E-03	5.4E-03	8.6E-03	8.6E-03	7.4E-06	1.5E-05	1.8E-06	0.021	0.014
New Hampshire	Total HG	0.030	0.011	0.043	0.027	0.050	0.050	1.6E-03	1.0E-04	1.1E-04	0.125	0.090
New Jersey	HGIIGAS	0.064	0.011	0.238	0.228	0.087	0.087	7.9E-04		4.9E-05	0.390	0.327
New Jersey	HGNRVA	0.061	0.014	0.403	0.321	0.108	0.108	8.4E-03		3.9E-04	0.580	0.451
New Jersey	PHGI	0.009	0.001	0.119	0.109	0.039	0.039	3.8E-05		8.7E-06	0.167	0.149
New Jersey	Total HG	0.133	0.026	0.761	0.658	0.233	0.233	9.3E-03		4.5E-04	1.137	0.927
New Mexico	HGIIGAS	0.042	0.010	4.7E-03	1.6E-03	5.8E-04	5.8E-04	2.5E-04		9.7E-06	0.048	0.012
New Mexico	HGNRVA	0.975	0.284	0.026	8.1E-03	9.3E-03	9.3E-03	2.6E-03		6.8E-05	1.013	0.304

		ptipm		ptnonipm		nonpt		onroad	alm	nonroad	all US sectors	
		[tons/yr]		[tons/yr]		[tons/yr]		[tons/yr]	[tons/yr]	[tons/yr]	[tons/yr]	
State	Species of	2005	2016	2005	2016	2005	2016	2005=2016	2005=2016	2005=2016	2005	2016
New Mexico	PHGI	0.010	1.8E-03	4.3E-03	1.4E-03	2.1E-04	2.1E-04	1.4E-05		2.3E-06	0.015	0.003
New Mexico	Total HG	1.027	0.296	0.035	0.011	0.010	0.010	2.9E-03		8.0E-05	1.076	0.320
New York	HGIIGAS	0.219	0.013	0.351	0.305	0.096	0.096	1.5E-03		9.4E-05	0.667	0.416
New York	HGNRVA	0.218	0.037	0.407	0.231	0.456	0.456	1.6E-02		7.5E-04	1.098	0.741
New York	PHGI	0.029	1.2E-03	0.158	0.124	0.062	0.062	7.3E-05		1.7E-05	0.249	0.187
New York	Total HG	0.465	0.051	0.916	0.660	0.614	0.614	1.8E-02		8.6E-04	2.014	1.344
North Carolina	HGIIGAS	1.122	0.118	0.132	0.119	0.015	0.015	9.1E-04		5.9E-05	1.270	0.252
North Carolina	HGNRVA	0.494	0.357	0.413	0.349	0.067	0.067	0.010		4.2E-04	0.985	0.783
North Carolina	PHGI	0.100	0.013	0.092	0.081	9.3E-03	9.3E-03	4.9E-05		1.4E-05	0.202	0.103
North Carolina	Total HG	1.716	0.487	0.638	0.549	0.091	0.091	0.011		4.9E-04	2.456	1.138
North Dakota	HGIIGAS	0.130	0.119	0.014	0.009	0.002	1.75E-03	7.7E-05		2.2E-05	0.145	0.129
North Dakota	HGNRVA	0.988	0.800	0.022	0.013	0.009	8.5E-03	8.1E-04		8.2E-05	1.019	0.823
North Dakota	PHGI	0.006	0.017	0.009	0.005	0.001	1.1E-03	4.4E-06		9.2E-06	0.016	0.023
North Dakota	Total HG	1.123	0.936	0.045	0.027	0.011	0.011	8.9E-04		1.1E-04	1.180	0.976
Ohio	HGIIGAS	1.687	0.440	0.331	0.224	0.013	0.013	1.1E-03		8.0E-05	2.032	0.678
Ohio	HGNRVA	1.841	1.074	1.513	0.859	0.090	0.090	0.012		5.5E-04	3.456	2.035
Ohio	PHGI	0.134	0.062	0.216	0.155	7.0E-03	7.0E-03	6.0E-05		1.9E-05	0.357	0.224
Ohio	Total HG	3.662	1.576	2.059	1.238	0.110	0.110	0.013		6.5E-04	5.845	2.937
Oklahoma	HGIIGAS	0.206	0.288	0.077	0.063	5.8E-04	5.8E-04	4.8E-04		2.8E-05	0.285	0.352
Oklahoma	HGNRVA	0.719	0.739	0.244	0.154	0.020	0.020	0.005		1.8E-04	0.988	0.918
Oklahoma	PHGI	1.8E-03	1.8E-03	0.057	0.044	2.5E-04	2.5E-04	2.6E-05		7.2E-06	0.059	0.046
Oklahoma	Total HG	0.927	1.028	0.379	0.260	0.020	0.020	5.6E-03		2.2E-04	1.332	1.315
Oregon	HGIIGAS	0.025	0.002	0.215	0.049	0.012	0.012	3.5E-04	2.1E-05	2.7E-05	0.252	0.064
Oregon	HGNRVA	0.056	0.005	1.154	0.206	0.040	0.040	3.7E-03	4.0E-05	1.9E-04	1.254	0.255
Oregon	PHGI	1.9E-04	1.1E-05	0.192	0.040	7.7E-03	7.7E-03	1.8E-05	1.1E-05	6.0E-06	0.200	0.047
Oregon	Total HG	0.081	7.5E-03	1.561	0.295	0.060	0.060	4.1E-03	7.1E-05	2.2E-04	1.706	0.367
Pennsylvania	HGIIGAS	2.856	0.459	0.635	0.514	0.064	0.064	1.1E-03		6.4E-05	3.556	1.038
Pennsylvania	HGNRVA	1.829	1.071	1.654	1.108	0.159	0.159	0.012		4.8E-04	3.655	2.351
Pennsylvania	PHGI	0.294	0.083	0.395	0.300	0.041	0.041	5.8E-05		1.3E-05	0.730	0.425
Pennsylvania	Total HG	4.979	1.613	2.684	1.923	0.264	0.264	0.013		5.6E-04	7.940	3.814
Rhode Island	HGIIGAS			0.014	0.014	8.8E-03	8.8E-03	9.0E-05		5.1E-06	0.023	0.023
Rhode Island	HGNRVA			0.023	0.023	0.019	0.019	9.6E-04		4.1E-05	0.043	0.043
Rhode Island	PHGI			9.3E-03	9.3E-03	5.7E-03	5.7E-03	4.0E-06		9.0E-07	0.015	0.015
Rhode Island	Total HG			0.047	0.047	0.033	0.033	1.1E-03		4.7E-05	0.081	0.081
South Carolina	HGIIGAS	0.319	0.166	0.314	0.231	3.1E-03	3.1E-03	5.1E-04		3.1E-05	0.636	0.400
South Carolina	HGNRVA	0.233	0.167	0.712	0.467	0.025	0.025	5.3E-03		2.2E-04	0.976	0.664
South Carolina	PHGI	0.029	0.015	0.176	0.124	1.9E-03	1.9E-03	2.7E-05		6.7E-06	0.207	0.141
South Carolina	Total HG	0.581	0.347	1.202	0.822	0.030	0.030	5.8E-03		2.6E-04	1.819	1.205

		ptipm		ptnonipm		nonpt		onroad	alm	nonroad	all US sectors	
		[tons/yr]		[tons/yr]		[tons/yr]		[tons/yr]	[tons/yr]	[tons/yr]	[tons/yr]	
State	Species of	2005	2016	2005	2016	2005	2016	2005= 2016	2005= 2016	2005= 2016	2005	2016
South Dakota	HGIIGAS	0.015	0.021	0.013	0.006	1.0E-03	1.0E-03	8.5E-05		1.7E-05	0.028	0.028
South Dakota	HGNRVA	0.033	6.4E-03	0.049	0.013	7.1E-03	7.1E-03	8.9E-04		6.9E-05	0.090	0.028
South Dakota	PHGI	8.2E-05	3.5E-04	0.010	4.4E-03	6.5E-04	6.5E-04	4.9E-06		6.5E-06	0.011	0.005
South Dakota	Total HG	0.048	0.027	0.071	0.024	8.8E-03	8.8E-03	9.8E-04		9.2E-05	0.129	0.061
Tennessee	HGIIGAS	0.634	0.194	0.285	0.173	2.0E-03	2.0E-03	7.1E-04		3.9E-05	0.922	0.370
Tennessee	HGNRVA	0.571	0.547	1.309	0.501	0.031	0.031	7.4E-03		2.7E-04	1.919	1.087
Tennessee	PHGI	0.046	0.001	0.152	0.096	1.2E-03	1.2E-03	4.1E-05		8.9E-06	0.200	0.099
Tennessee	Total HG	1.251	0.743	1.746	0.771	0.034	0.034	8.2E-03		3.2E-04	3.040	1.556
Texas	HGIIGAS	1.520	0.804	0.805	0.606	1.2E-03	1.2E-03	2.3E-03		1.4E-04	2.329	1.414
Texas	HGNRVA	3.584	2.501	3.269	2.592	0.071	0.071	0.024		9.0E-04	6.949	5.188
Texas	PHGI	0.092	0.063	0.576	0.446	8.1E-04	8.1E-04	1.4E-04		3.5E-05	0.669	0.511
Texas	Total HG	5.196	3.367	4.650	3.644	0.073	0.073	0.027		1.1E-03	9.947	7.112
Tribal Data	HGIIGAS			3.2E-04	3.2E-04						0.000	0.000
Tribal Data	HGNRVA			5.4E-04	5.3E-04						0.001	0.001
Tribal Data	PHGI			2.1E-04	2.1E-04						0.000	0.000
Tribal Data	Total HG			1.1E-03	1.1E-03						0.001	0.001
Utah	HGIIGAS	0.063	0.062	0.085	0.059	4.0E-04	4.0E-04	2.6E-04		1.6E-05	0.149	0.122
Utah	HGNRVA	0.079	0.114	0.232	0.115	0.014	0.014	2.7E-03		1.2E-04	0.328	0.246
Utah	PHGI	0.006	0.008	0.052	0.032	1.9E-04	1.9E-04	1.4E-05		3.5E-06	0.058	0.040
Utah	Total HG	0.148	0.184	0.369	0.206	0.015	0.015	3.0E-03		1.4E-04	0.536	0.408
Vermont	HGIIGAS	1.7E-03		2.4E-04	2.4E-04	9.4E-03	9.4E-03	7.5E-05		5.7E-06	0.011	0.010
Vermont	HGNRVA	2.8E-03		6.2E-04	6.2E-04	0.018	0.018	7.9E-04		4.7E-05	0.022	0.019
Vermont	PHGI	1.1E-03		1.6E-04	1.6E-04	5.5E-03	5.5E-03	4.1E-06		9.4E-07	0.007	0.006
Vermont	Total HG	5.6E-03		1.0E-03	1.0E-03	0.033	0.033	8.7E-04		5.3E-05	0.040	0.035
Virginia	HGIIGAS	0.401	0.108	0.496	0.235	0.019	0.019	8.5E-04		4.6E-05	0.917	0.364
Virginia	HGNRVA	0.181	0.146	0.938	0.421	0.069	0.069	9.0E-03		3.3E-04	1.197	0.646
Virginia	PHGI	0.042	0.029	0.309	0.132	0.012	0.012	4.3E-05		1.0E-05	0.363	0.174
Virginia	Total HG	0.624	0.284	1.743	0.789	0.100	0.100	9.9E-03		3.9E-04	2.477	1.183
Washington	HGIIGAS	0.105	0.005	0.047	0.030	6.1E-03	6.1E-03	5.7E-04	3.6E-03	4.3E-05	0.162	0.045
Washington	HGNRVA	0.234	0.161	0.123	0.057	0.041	0.041	5.9E-03	6.9E-03	3.1E-04	0.412	0.272
Washington	PHGI	5.3E-04	7.1E-04	0.032	0.018	3.1E-03	3.1E-03	3.1E-05	1.8E-03	9.8E-06	0.037	0.024
Washington	Total HG	0.339	0.167	0.202	0.104	0.050	0.050	6.5E-03	0.012	3.6E-04	0.611	0.341
West Virginia	HGIIGAS	1.449	0.226	0.097	0.071	2.6E-03	2.6E-03	2.0E-04		9.7E-06	1.549	0.300
West Virginia	HGNRVA	0.827	0.610	0.301	0.202	0.015	0.015	2.1E-03		7.5E-05	1.144	0.829
West Virginia	PHGI	0.129	0.024	0.056	0.041	1.7E-03	1.7E-03	1.1E-05		1.8E-06	0.186	0.067
West Virginia	Total HG	2.404	0.860	0.454	0.314	0.019	0.019	2.3E-03		8.7E-05	2.880	1.196
Wisconsin	HGIIGAS	0.355	0.169	0.277	0.259	0.011	0.011	6.2E-04		6.1E-05	0.644	0.439
Wisconsin	HGNRVA	0.784	0.692	0.438	0.396	0.053	0.053	6.5E-03		4.8E-04	1.282	1.149
Wisconsin	PHGI	7.7E-03	0.010	0.172	0.160	7.1E-03	7.1E-03	3.3E-05		1.2E-05	0.187	0.177

		ptipm		ptnonipm		nonpt		onroad	alm	nonroad	all US sectors	
		[tons/yr]		[tons/yr]		[tons/yr]		[tons/yr]	[tons/yr]	[tons/yr]	[tons/yr]	
State	Species of	2005	2016	2005	2016	2005	2016	2005=2016	2005=2016	2005=2016	2005	2016
Wisconsin	Total HG	1.147	0.870	0.887	0.815	0.072	0.072	7.1E-03		5.5E-04	2.114	1.765
Wyoming	HGIIGAS	0.072	0.134	0.076	0.056	4.0E-04	4.0E-04	9.2E-05		5.9E-06	0.149	0.191
Wyoming	HGNRVA	0.872	1.119	0.147	0.098	3.6E-03	3.6E-03	9.5E-04		4.3E-05	1.023	1.222
Wyoming	PHGI	0.004	0.006	0.052	0.038	2.3E-04	2.3E-04	5.3E-06		1.3E-06	0.057	0.045
Wyoming	Total HG	0.949	1.260	0.275	0.192	4.2E-03	4.2E-03	1.1E-03		5.0E-05	1.23	1.46
Total (48 state)	HGIIGAS	21.096	6.876	10.469	7.911	1.060	1.060	0.140	0.041	0.104	32.91	16.13
Total (48 state)	HGNRVA	30.199	21.160	29.569	16.853	3.103	3.103	0.504	0.079	0.211	63.66	41.91
Total (48 state)	PHGI	1.614	0.668	6.129	4.418	0.652	0.652	0.060	0.021	0.053	8.53	5.87
Total (48 state)	Total HG	52.908	28.704	46.166	29.183	4.816	4.816	0.704	0.142	0.368	105.10	63.92

Table 5-4. EGU sector (ptipm emissions) for all AQ modeling cases: NO_X, SO_2 and VOC

EGU sector emissions (AQ modeling cases) [tons/yr]

State	2005 NOX	2016 Base NOX	2016 Policy NOX		2005 SO2	2016 Policy SO2	2016 Policy SO2		2005 VOC	2016 Base VOC	2016 Policy VOC
Alabama	133,051	59,339	59,118		460,123	172,198	38,346		1,366	1,375	1,311
Arizona	79,776	60,265	60,279		52,733	23,140	21,632		577	892	887
Arkansas	35,407	20,095	15,563		66,384	93,754	7,314		480	619	505
California	6,916	13,640	13,454		601	4,740	4,148		822	752	740
Colorado	73,909	55,507	55,555		64,174	55,588	19,698		914	643	672
Connecticut	6,865	2,410	2,406		10,356	2,643	2,041		307	106	123
Delaware	11,917	1,699	2,580		32,378	1,717	3,359		99	55	102
District of Columbia	492				1,082				3		
Florida	217,263	55,818	54,686		417,321	122,123	57,439		2,054	1,821	1,832
Georgia	111,017	37,138	32,293		616,054	91,885	40,767		1,303	1,176	1,140
Idaho	19	100	100		0	0	0		0	14	14
Illinois	127,923	47,093	45,501		330,382	148,934	47,403		1,586	2,169	2,260
Indiana	213,503	94,741	80,329		878,978	229,248	111,741		2,508	2,088	1,930
Iowa	72,806	40,921	40,720		130,264	98,518	22,208		536	781	790
Kansas	90,220	24,943	20,198		136,520	61,622	12,781		948	703	603
Kentucky	164,743	68,087	64,619		502,731	123,010	97,707		1,487	1,566	1,360
Louisiana	63,791	30,380	31,244		109,851	98,808	32,624		1,017	720	753
Maine	1,100	921	316		3,887	1,123	0		60	60	51
Maryland	62,574	17,076	15,904		283,205	36,211	11,528		483	475	447
Massachusetts	25,135	4,611	4,222		84,234	4,236	2,556		584	226	227

EGU sector emissions (AQ modeling cases) [tons/yr]

State	2005 NOX	2016 Base NOX	2016 Policy NOX		2005 SO2	2016 Policy SO2	2016 Policy SO2		2005 VOC	2016 Base VOC	2016 Policy VOC
Michigan	120,005	59,629	55,318		349,877	169,853	27,922		1,230	1,197	1,065
Minnesota	83,836	26,063	27,015		101,666	51,952	27,805		633	643	649
Mississippi	45,166	19,460	17,915		75,047	55,317	10,595		574	412	419
Missouri	127,431	48,179	39,012		284,384	172,031	32,412		1,597	1,774	1,545
Montana	39,858	18,898	21,564		19,715	13,234	9,071		396	261	289
Nebraska	52,426	28,822	29,767		74,955	74,642	34,551		675	545	558
Nevada	47,297	13,936	13,426		53,363	11,283	4,735		524	358	355
New Hampshire	8,827	1,807	1,074		51,445	4,348	730		136	110	100
New Jersey	30,114	9,335	9,449		57,044	8,507	6,997		1,188	322	308
New Mexico	75,483	63,427	63,819		30,628	11,370	9,357		576	542	537
New York	63,315	16,540	15,689		180,847	28,911	13,468		801	709	643
North Carolina	111,576	41,827	37,686		512,231	82,544	34,946		936	970	894
North Dakota	76,381	57,537	27,243		137,371	76,081	11,955		763	847	419
Ohio	258,688	90,904	74,788		1,116,084	204,291	77,852		1,751	1,855	1,485
Oklahoma	86,204	45,639	41,722		110,081	139,800	14,196		1,029	917	897
Oregon	9,383	8,139	8,139		12,304	11,102	1,423		141	157	157
Pennsylvania	176,870	107,224	97,220		1,002,201	152,929	73,714		1,153	1,822	1,492
Rhode Island	545	264	271		176	0	0		35	44	45
South Carolina	52,657	34,193	30,342		218,781	128,070	35,223		533	629	625
South Dakota	15,650	14,249	13,641		12,215	29,711	7,490		106	127	118
Tennessee	102,934	31,885	20,003		266,148	106,762	44,110		798	940	764
Texas	176,170	127,355	121,488		534,949	334,636	81,000		3,851	5,025	4,941
Utah	65,261	68,049	61,311		34,813	31,343	14,261		368	489	467
Vermont	297	0	0		9	0	0		22	0	0
Virginia	62,512	29,140	33,922		220,248	45,345	16,029		646	577	560
Washington	17,634	10,424	10,425		3,409	2,804	2,804		248	201	201
West Virginia	159,947	57,493	51,936		469,456	127,826	44,129		1,141	1,210	1,171
Wisconsin	72,170	32,755	26,950		180,200	77,871	24,481		980	999	880
Wyoming	89,315	71,795	67,968		89,874	55,636	25,831		848	923	886
Tribal Data	78	11	11		3	0	0		133	2	2
Total	3,726,459	1,769,764	1,618,199		10,380,783	3,577,698	1,220,379		40,950	40,845	38,217

Table 5-5. EGU sector (ptipm emissions) for all AQ modeling cases: HCL and total Mercury

EGU sector emissions (AQ modeling cases) [tons/yr]							
State	2005 HCL	2016 Base HCL	2016 Cntl HCL (tons)		2005 Total Hg	2016 Base Total Hg	2016 Cntl Total Hg
Alabama	12431	6713	181		3.0126	1.2550	0.1919
Arizona	9323	129	69		0.8839	0.7487	0.0891
Arkansas	8381	1355	13		0.7112	0.7246	0.0664
California	9	14	16		0.1375	0.1322	0.0842
Colorado	269	757	196		0.4710	0.0832	0.0902
Connecticut	823	188	8		0.1273	0.0069	0.0064
Delaware	876	59	71		0.1974	0.0090	0.0210
District of Columbia					0.0028	0.0000	0.0000
Florida	14351	3323	176		1.4855	0.4859	0.1926
Georgia	21811	1205	411		2.0396	0.5115	0.2153
Idaho					0.0000	0.0000	0.0000
Illinois	12888	2118	325		4.4081	0.4879	0.2868
Indiana	24637	4171	980		3.4409	1.5583	0.3800
Iowa	1890	1482	185		1.3696	0.9994	0.1524
Kansas	12010	733	62		1.1291	0.9551	0.0973
Kentucky	18930	3818	375		2.0195	0.8278	0.3134
Louisiana	9648	1155	74		1.0124	1.0188	0.1656
Maine	0	12	0		0.0140	0.0129	0.0000
Maryland	6380	685	104		0.9711	0.1144	0.1158
Massachusetts	1124	29	15		0.1892	0.0094	0.0104
Michigan	15921	2615	292		2.1998	1.5010	0.1739
Minnesota	489	413	172		0.7504	0.1610	0.0743
Mississippi	1150	787	169		0.4469	0.4048	0.0526
Missouri	2775	2783	199		2.3493	1.9487	0.2424
Montana	6793	104	37		0.5311	0.0968	0.0446
Nebraska	6137	1203	99		0.5419	0.4228	0.0844
Nevada	5185	222	76		0.3315	0.0874	0.0563
New Hampshire	1009	60	11		0.0363	0.0108	0.0108
New Jersey	1896	206	22		0.1576	0.0257	0.0258
New Mexico	8786	55	64		1.0439	0.2958	0.0867
New York	4692	421	191		0.4932	0.0510	0.0425
North Carolina	28180	2749	550		1.9284	0.4868	0.2072
North Dakota	15088	526	50		1.2685	0.9364	0.0626
Ohio	32,396	6065	1038		4.4451	1.5759	0.6395
Oklahoma	130	1867	31		1.2226	1.0285	0.1046
Oregon		116	1		0.0841	0.0075	0.0075
Pennsylvania	26637	5482	489		5.7308	1.6132	0.5168
Rhode Island					0.0000	0.0000	0.0000

EGU sector emissions (AQ modeling cases) [tons/yr]							
State	2005 HCL	2016 Base HCL	2016 Cntl HCL (tons)		2005 Total Hg	2016 Base Total Hg	2016 Cntl Total Hg
South Carolina	8900	5339	512		0.8209	0.3472	0.1422
South Dakota	1065	118	27		0.0766	0.0272	0.0119
Tennessee	12685	1283	146		1.4991	0.7427	0.1526
Texas	3119	4339	388		6.1284	3.3674	0.5362
Utah		362	51		0.2488	0.1838	0.0784
Vermont	1811				0.0056	0.0000	0.0000
Virginia	31	2538	154		0.8099	0.2842	0.1142
Washington	5729	3	3		0.3457	0.1666	0.0198
West Virginia	41	4368	336		2.8543	0.8600	0.5046
Wisconsin	3365	1534	275		1.3562	0.8701	0.1464
Wyoming	1630	584	158		1.1254	1.2596	0.2197
Tribal Data	172				0.0000	0.0000	0.0000
Total	351,592	74,089	8,802		62.4551	28.7038	6.8376

Table 5-6. EGU sector (ptipm emissions) for all AQ modeling cases: Speciated Mercury

EGU sector emissions (AQ modeling cases) [tons/yr]											
State	2005 PHGI	2016 Base PHGI	2016 PHGI cntl		2005 HGIIGAS	2016 Base HGIIGAS	2016 Cntl HGIIGAS		2005 HGNRVA	2016 Base HGNRVA	2016 Cntl HGNRVA
Alabama	0.0836	0.0187	0.0069		1.1605	0.2878	0.0361		1.4190	0.9485	0.1489
Arizona	0.0068	0.0071	0.0048		0.0516	0.1330	0.0232		0.6575	0.6086	0.0611
Arkansas	0.0009	0.0011	0.0004		0.1438	0.1982	0.0023		0.3644	0.5253	0.0637
California	0.0010	0.0391	0.0289		0.0009	0.0415	0.0232		0.0028	0.0516	0.0321
Colorado	0.0048	0.0029	0.0028		0.1028	0.0257	0.0108		0.3211	0.0546	0.0765
Connecticut	0.0036	0.0002	0.0005		0.0396	0.0039	0.0020		0.0774	0.0027	0.0039
Delaware	0.0158	0.0002	0.0011		0.1090	0.0061	0.0105		0.0547	0.0027	0.0094
District of Columbia	0.0006				0.0008				0.0014		
Florida	0.0795	0.0814	0.0256		0.5435	0.1449	0.0603		0.5503	0.2596	0.1067
Georgia	0.0738	0.0086	0.0139		0.9645	0.2413	0.0717		0.6659	0.2616	0.1298
Idaho		0.0000	0.0000			0.0000	0.0000			0.0000	0.0000
Illinois	0.0562	0.0035	0.0059		1.3672	0.1235	0.0328		2.8189	0.3609	0.2481
Indiana	0.0682	0.0106	0.0206		1.1407	0.4173	0.1131		1.6704	1.1304	0.2463
Iowa	0.0035	0.0042	0.0014		0.2788	0.1932	0.0128		0.8757	0.8020	0.1382
Kansas	0.0066	0.0036	0.0006		0.1674	0.1141	0.0032		0.8336	0.8375	0.0935
Kentucky	0.0624	0.0146	0.0199		0.7987	0.1310	0.0954		0.8974	0.6822	0.1980
Louisiana	0.0021	0.0987	0.0238		0.1478	0.2443	0.0364		0.4593	0.6757	0.1054
Maine	0.0009	0.0008	0.0000		0.0013	0.0088	0.0000		0.0022	0.0033	0.0000
Maryland	0.0532	0.0064	0.0085		0.5354	0.0314	0.0347		0.3014	0.0766	0.0725
Massachusetts	0.0159	0.0004	0.0007		0.1107	0.0027	0.0038		0.0551	0.0063	0.0059

EGU sector emissions (AQ modeling cases) [tons/yr]

State	2005 PHGI	2016 Base PHGI	2016 PHGI cntl		2005 HGIIGAS	2016 Base HGIIGAS	2016 Cntl HGIIGAS		2005 HGNRVA	2016 Base HGNRVA	2016 Cntl HGNRVA
Michigan	0.0771	0.0058	0.0035		0.9683	0.3404	0.0239		0.7808	1.1548	0.1465
Minnesota	0.0087	0.0012	0.0006		0.0957	0.0357	0.0058		0.6027	0.1241	0.0679
Mississippi	0.0103	0.0012	0.0009		0.1258	0.1399	0.0132		0.1557	0.2637	0.0385
Missouri	0.0236	0.0050	0.0024		0.7019	0.4725	0.0154		1.1286	1.4712	0.2247
Montana	0.0070	0.0108	0.0026		0.0297	0.0103	0.0030		0.4677	0.0757	0.0391
Nebraska	0.0015	0.0020	0.0009		0.1180	0.1684	0.0268		0.2244	0.2525	0.0567
Nevada	0.0017	0.0015	0.0012		0.0911	0.0113	0.0077		0.2170	0.0745	0.0474
New Hampshire	0.0039	0.0003	0.0007		0.0149	0.0015	0.0036		0.0115	0.0090	0.0066
New Jersey	0.0086	0.0012	0.0014		0.0636	0.0109	0.0112		0.0607	0.0136	0.0133
New Mexico	0.0101	0.0018	0.0007		0.0423	0.0099	0.0041		0.9750	0.2841	0.0819
New York	0.0286	0.0013	0.0022		0.2188	0.0128	0.0116		0.2179	0.0370	0.0288
North Carolina	0.0999	0.0126	0.0138		1.1218	0.1175	0.0686		0.4942	0.3567	0.1249
North Dakota	0.0056	0.0169	0.0004		0.1296	0.1190	0.0092		0.9878	0.8005	0.0530
Ohio	0.1341	0.0619	0.0450		1.6872	0.4396	0.2362		1.8411	1.0744	0.3582
Oklahoma	0.0018	0.0018	0.0010		0.2063	0.2882	0.0047		0.7188	0.7386	0.0989
Oregon	0.0002	0.0000	0.0001		0.0251	0.0023	0.0003		0.0561	0.0052	0.0071
Pennsylvania	0.2941	0.0834	0.0309		2.8559	0.4587	0.1787		1.8292	1.0711	0.3072
Rhode Island		0.0000	0.0000			0.0000	0.0000			0.0000	0.0000
South Carolina	0.0287	0.0146	0.0094		0.3191	0.1660	0.0496		0.2334	0.1666	0.0832
South Dakota	0.0001	0.0004	0.0001		0.0147	0.0205	0.0078		0.0330	0.0064	0.0040
Tennessee	0.0461	0.0013	0.0087		0.6343	0.1939	0.0440		0.5707	0.5475	0.1000
Texas	0.0920	0.0631	0.0143		1.5203	0.8036	0.0513		3.5838	2.5007	0.4706
Utah	0.0058	0.0076	0.0050		0.0634	0.0623	0.0256		0.0790	0.1139	0.0478
Vermont	0.0011	0.0000	0.0000		0.0017	0.0000	0.0000		0.0028	0.0000	0.0000
Virginia	0.0423	0.0295	0.0079		0.4006	0.1083	0.0402		0.1810	0.1464	0.0661
Washington	0.0005	0.0007	0.0001		0.1046	0.0049	0.0006		0.2342	0.1610	0.0192
West Virginia	0.1286	0.0244	0.0328		1.4490	0.2259	0.1668		0.8268	0.6097	0.3050
Wisconsin	0.0077	0.0095	0.0069		0.3549	0.1686	0.0246		0.7840	0.6920	0.1148
Wyoming	0.0043	0.0064	0.0022		0.0723	0.1340	0.0341		0.8721	1.1192	0.1834
Tribal Data		0.0000	0.0000			0.0000	0.0000			0.0000	0.0000
Total	1.61	0.67	0.3620		21.10	6.88	1.6409		30.20	21.16	4.8347

Table 5-7. 2016 Base Case SO_2 Emissions (tons/year) for Lower 48 States by Sector

State	EGU	Non-EGU	Nonpoint	Nonroad + Alm_no_c3+ Seca_c3	Onroad	Fires	Total
Alabama	172,198	65,649	52,312	197	513	983	291,850
Arizona	23,140	24,206	2,566	52	626	2,888	53,477
Arkansas	93,754	12,910	27,255	142	286	728	135,075
California	4,740	22,148	77,610	8,489	2,216	6,735	121,938
Colorado	55,588	1,425	6,469	47	529	1,719	65,778
Connecticut	2,643	1,832	18,438	100	275	4	23,291

State	EGU	Non-EGU	Nonpoint	Nonroad + Alm_no_c3+ Seca_c3	Onroad	Fires	Total
Delaware	1,717	6,299	5,857	715	79	6	14,673
District of Columbia	0	686	1,559	3	36	0	2,284
Florida	122,123	40,662	70,479	4,530	1,901	7,018	246,713
Georgia	91,885	42,407	56,812	430	1,108	2,010	194,652
Idaho	0	17,137	2,911	21	167	3,845	24,082
Illinois	148,934	85,834	5,380	319	1,036	20	241,524
Indiana	229,248	64,088	59,764	160	675	24	353,959
Iowa	98,518	19,010	19,816	85	291	25	137,745
Kansas	61,622	12,708	36,374	55	257	103	111,119
Kentucky	123,010	18,773	34,208	257	436	364	177,048
Louisiana	98,808	146,371	2,371	3,979	402	892	252,824
Maine	1,123	7,803	9,943	194	131	150	19,345
Maryland	36,211	13,623	40,850	1,055	513	32	92,284
Massachusetts	4,236	16,168	25,235	1,368	497	93	47,597
Michigan	169,853	24,072	42,066	440	919	91	237,440
Minnesota	51,952	18,728	14,727	252	500	631	86,789
Mississippi	55,317	22,327	6,785	244	332	1,051	86,055
Missouri	172,031	65,392	44,540	214	652	186	283,016
Montana	13,234	7,858	1,959	24	105	1,422	24,603
Nebraska	74,642	4,777	29,569	55	181	105	109,329
Nevada	11,283	2,134	12,474	25	187	1,346	27,449
New Hampshire	4,348	2,578	7,391	22	120	38	14,496
New Jersey	8,507	6,758	10,711	1,300	661	61	27,998
New Mexico	11,370	8,065	2,833	24	237	3,450	25,978
New York	28,911	20,812	125,199	979	1,303	113	177,318
North Carolina	82,544	45,264	21,992	2,177	811	696	153,484
North Dakota	76,081	9,678	5,766	35	62	66	91,688
Ohio	204,291	58,216	19,810	422	969	22	283,731
Oklahoma	139,800	31,097	7,535	45	436	469	179,382
Oregon	11,102	8,597	9,846	787	369	4,896	35,598
Pennsylvania	152,929	46,609	68,322	458	981	32	269,332
Rhode Island	0	2,725	3,364	129	72	1	6,291
South Carolina	128,070	22,746	30,001	1,037	462	646	182,963
South Dakota	29,711	1,947	10,298	22	76	498	42,552
Tennessee	106,762	39,433	32,695	173	695	277	180,036
Texas	334,636	138,883	110,147	2,103	2,084	1,178	589,030
Tribal	0	1,495		0			1,495
Utah	31,343	8,034	3,425	25	297	1,934	45,057
Vermont	0	903	5,379	7	90	49	6,428
Virginia	45,345	47,045	32,897	771	756	399	127,213
Washington	2,804	19,131	7,227	1,432	654	407	31,655
West Virginia	127,826	23,305	14,580	75	161	215	166,162
Wisconsin	77,871	18,573	6,370	123	554	70	103,561
Wyoming	55,636	22,118	6,180	18	86	1,106	85,146
Total	**3,577,698**	**1,349,038**	**1,250,300**	**35,616**	**26,784**	**49,094**	**6,288,529**

*Non-US seca_c3 component not included. These emissions are 957,065 tons/yr.

Table 5-8. 2016 Base Case PM2.5 Emissions (tons/year) for Lower 48 States by Sector

State	EGU	Non-EGU	Nonpoint	Nonroad + Alm_no_c3 +Seca_c3	Onroad	Fires	Area Fugitive Dust	Total
Alabama	14,801	17,064	22,982	2,576	1,631	13,938	11,591	84,583

State	EGU	Non-EGU	Nonpoint	Nonroad + Alm_no_c3 +Seca_c3	Onroad	Fires	Area Fugitive Dust	Total
Arizona	10,196	3,804	8,178	2,836	1,817	37,151	12,806	76,788
Arkansas	3,805	9,905	22,683	2,191	1,108	10,315	11,681	61,689
California	9,718	20,859	69,736	17,963	17,777	97,302	20,386	253,741
Colorado	4,972	7,007	12,854	2,490	4,373	24,054	11,794	67,544
Connecticut	1,632	225	9,303	1,090	2,988	56	1,014	16,308
Delaware	643	1,906	1,675	477	514	87	497	5,801
District of Columbia	0	172	407	151	229	0	162	1,121
Florida	26,114	18,264	37,931	10,096	4,168	99,484	14,126	210,183
Georgia	14,411	12,161	40,435	4,131	3,803	24,082	21,286	120,309
Idaho	187	2,067	27,023	1,267	1,555	52,808	14,154	99,060
Illinois	11,157	14,266	13,753	7,429	10,062	277	58,864	115,808
Indiana	21,198	13,572	31,618	3,769	5,586	344	41,832	117,919
Iowa	5,223	5,688	10,176	3,593	3,816	349	42,837	71,682
Kansas	4,634	7,556	82,581	3,078	1,736	1,468	55,263	156,315
Kentucky	13,598	10,341	16,928	2,899	2,342	5,155	12,655	63,917
Louisiana	5,219	36,644	17,365	6,491	1,000	12,647	10,302	89,669
Maine	712	3,143	11,958	985	1,876	2,127	1,312	22,114
Maryland	3,791	6,153	18,742	2,304	3,584	531	3,559	38,665
Massachusetts	2,754	2,127	24,749	2,531	5,278	1,324	4,580	43,343
Michigan	7,188	11,115	22,374	5,048	10,955	1,283	23,506	81,470
Minnesota	9,011	9,665	22,535	5,035	10,917	8,943	49,495	115,600
Mississippi	2,554	9,491	15,685	2,495	876	14,897	17,454	63,451
Missouri	8,040	6,334	25,550	4,217	4,335	2,636	48,202	99,315
Montana	2,453	2,528	4,925	1,427	1,239	17,311	24,528	54,412
Nebraska	2,657	1,857	8,177	3,177	1,760	1,483	37,482	56,593
Nevada	10,903	4,029	2,612	1,364	732	19,018	7,185	45,843
New Hampshire	1,138	508	11,543	610	1,588	534	658	16,578
New Jersey	3,380	2,577	11,837	3,358	5,483	865	549	28,049
New Mexico	5,785	1,445	5,006	1,220	1,178	48,662	45,353	108,648
New York	7,580	4,442	37,074	5,432	13,467	1,601	13,647	83,242
North Carolina	12,185	11,775	36,080	4,746	3,172	9,870	11,162	88,990
North Dakota	5,338	569	2,807	2,293	1,735	934	38,263	51,940
Ohio	19,844	12,251	22,428	5,908	8,425	316	28,587	97,759
Oklahoma	7,412	5,669	45,423	2,165	1,856	6,644	44,243	113,412
Oregon	1,653	8,161	47,545	2,517	1,917	65,350	8,738	135,881
Pennsylvania	21,187	13,237	29,061	4,839	8,838	454	13,344	90,961
Rhode Island	598	256	1,035	281	758	14	182	3,124
South Carolina	11,831	4,477	16,869	2,372	1,548	9,163	9,162	55,421
South Dakota	768	2,145	3,959	1,445	1,128	7,062	29,215	45,722
Tennessee	6,637	21,495	19,126	3,129	3,034	3,934	11,900	69,254
Texas	37,320	34,923	47,953	13,048	6,101	21,578	143,814	304,737
Tribal	32	1,557		0	0			1,589
Utah	5,011	3,564	8,859	1,021	2,328	27,412	5,682	53,877
Vermont	0	337	4,882	325	1,250	696	1,528	9,018
Virginia	7,141	10,840	27,774	3,938	4,315	5,659	8,194	67,861
Washington	1,927	4,197	30,049	3,737	3,665	4,487	13,617	61,680
West Virginia	16,198	4,921	10,405	1,114	1,084	3,050	3,649	40,423
Wisconsin	6,376	7,430	24,646	3,639	8,423	994	11,870	63,379

State	EGU	Non-EGU	Nonpoint	Nonroad + Alm_no_c3 +Seca_c3	Onroad	Fires	Area Fugitive Dust	Total
Wyoming	7,406	10,207	2,620	896	967	15,686	28,723	66,505
Grand Total	**384,320**	**404,926**	**1,029,916**	**169,144**	**188,320**	**684,035**	**1,030,631**	**3,891,291**

*Non-US seca_c3 component not included. These emissions are 120,617 tons/yr.

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